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Associations between common mental health difficulties and alcohol use in an adult population

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Word Count

Section One: Literature Review

Excluding references and tables – 7,967 words.

Including references and tables – 12,394 words.

Section Two: Empirical Study

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Thesis abstract

Alcohol use and common mental health problems (i.e. anxiety and depression) often co-occur as a dual diagnosis (DD). However, there is a lack of services providing integrated interventions for DD. Psychological therapists often perceive people with DD who are dependent on substances as less likely to benefit from and engage with psychological treatment when compared to those who have a single diagnosis. Some literature has supported this belief; however, the actual evidence is mixed. Despite a lack of clear evidence, some services will exclude clients due to their DD.

A review of the existing literature was undertaken to investigate associations between alcohol use and depression severity. 12 articles, using 11 independent samples, met the inclusion criteria and were combined in a meta-analysis. There was a small positive correlation between alcohol use and depression severity, therefore as depression severity increases, alcohol use increases. Moderator analyses were carried out to investigate other variables that might affect this association. Results indicated that the measures used to quantify alcohol use and risk of bias ratings moderated this association. A sensitivity analysis was carried out, systematically removing articles depending on their characteristics, and the results were mainly congruent with the primary meta-analysis, except for gender. Overall, results should be interpreted with caution due to the heterogeneity and publication bias.

To investigate the association between common mental health difficulties and alcohol use further, clinical data from *n*=7,986 participants, aged between 16-89 years old (*n*=2,760 male) were analysed using a hierarchical regression model. The analysis examined linear and curvilinear associations between alcohol use or severity of

dependence (SD) with depression severity, anxiety severity, and number of psychological therapy contacts attended. The SD was investigated in a subsample (*n*=195 participants). Participants were recruited from a primary care mental health service and provided consent for their data to be analysed for research purposes.

Results indicated participants who drank moderately and extremely hazardously had lower baseline depression scores when compared to those who drank at low levels and hazardously. Participants who drank moderately had lower post-treatment anxiety scores when compared to those who drank at low and hazardous levels. Both relationships were controlled by variables; age, baseline anxiety, functional impairment, disability, employment status, expectancy, baseline depression (post-treatment anxiety only), and ethnicity (post-treatment anxiety only). Alcohol use was not associated with baseline anxiety, post treatment depression or contacts attended after controlling for independent variables. SDS was not associated with any variables after controlling for independent variables. Participants completed self-reporting questionnaires, which could create bias, and data was limited to a primary care mental health service; therefore conclusions should be generalised with caution.

Overall, alcohol use and common mental health problems commonly co-occur. It could be beneficial for services to consider comorbidity and integrate this information into treatment plans. It is important for services to discuss the relationship between alcohol use and mental health, taking into account the different factors that influence the relationship (e.g. age, disability, and employment status). Therefore, services could take this into consideration prior to exclusion.

Acknowledgements

During the last four years I have been on an incredible journey, from the dizzy heights of becoming a mother for a second time to the darkest depths of statistics hell! Both my mental and physical health have been pushed to its limits, however, I can now see the light at the end of the tunnel and would not have been able to do this without the encouragement from my husband and mother. I am eternally grateful for all the support, the endless cups of tea and child fun days they have both provided. I also feel thankful that this research can have a direct impact on client care, as this makes all the late nights worthwhile.

I would also like to say a big thank you to my research supervisor, Dr Jaime Delgadillo. Jaime is an ambassador for clients with mental health difficulties and his passion for statistics has helped guide me on my journey.

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Section 1 – Literature review

Abstract

Objectives: The review aimed to investigate the association between alcohol use and depression severity. Generally, clinicians assume that as alcohol use increases, people are less likely to engage with or benefit from therapy, however there is inconsistent evidence to support this assumption.

Methods: Four databases (Scopus, Medline, Psycinfo and Web of Science) were searched, using terms: alcohol AND depress* OR low mood OR affective disorder* AND screening tools for depression. This returned 12,660 articles for screening. Selected articles were assessed for bias and quality, before a meta-analysis was conducted. A moderator analysis was conducted using variables; alcohol measure, depression measure and quality of article. A sensitivity analysis was conducted on the effects of gender, study design, alcohol measure, depression measure, adjusted statistics that include confounding variables, and quality of articles.

Results: A total of 12 articles met the inclusion criteria, with 11 independent samples, totalling, *n*=17,366 participants (*n*=10,209 female), aged 18-105 years old. The meta-analysis explored the association between alcohol use and depression severity; the pooled weighted mean effect size was r=0.22, (0.02-0.39), $p<0.01$, indicating a small positive correlation. Moderator analysis indicated the association was moderated by the article quality and alcohol use tool.

Conclusion: As depression severity increases, alcohol use increases. This relationship was moderated by alcohol use measures and risk of bias ratings. Results should be interpreted with caution, due to the large amount of heterogeneity (I^2=99.3%) and evidence of publication bias.

Practitioner points

- When conducting an assessment, it is important to consider the client's depression severity and alcohol use, to identify the impact, if any, on their well-being and functioning.
- Due to the common co-occurrence of alcohol use and depression, it is important that services avoid discriminating against people with a dual diagnosis, especially as this study only found a small effect size.

Limitations

- The search strategy did not include grey literature or articles in languages other than English, which could have contributed to the publication bias.
- There was a large amount of heterogeneity within the articles; therefore, caution should be taken when combining the articles. For example, there were numerous measures of alcohol use, which was identified as a moderator of the study.
- The articles had a vast amount of heterogeneity, especially in the demographic features, i.e. country of origin and date of data collection.

Key words: Alcohol, depression, association, meta-analysis, dual diagnosis

A meta-analysis to review the association between alcohol use and depression severity in an adult population

Alcohol use

Historians have documented that people have consumed alcohol since 10,000 BC (Before Christ); however, the context of alcohol use has changed dramatically over time. Today, alcohol use is a common aspect of social life and British culture. Alcohol use is a highly debated topic within society and the Government is placing more emphasis on the detrimental effects of alcohol use, especially as drinking to excess has become more prevalent (Vetter, 2012). The Government's chief medical officer currently recommends that both males and females should drink less than 14 units per week, and to spread this out over at least 3 days. These guidelines were developed in 2016. This was a decrease for men, from 21 units a week, which was the level originally set in 1995. Typically, a pint of 4.8% alcohol by volume (ABV) lager is 2.7 units, and a 175ml glass of 14% ABV wine is 2.5 units (Lea, 2016). It has been estimated that 1 in 5 (19.7%) adults drink alcohol above the recommended guidance and are classed as hazardous drinkers (Drummond, McBride, Fear, & Fuller, 2016).

Alcohol use is associated with various detrimental effects, for example it can increase the risk of physical illnesses such as cancer (Burton & Sheron, 2018). Alcohol use has also been associated with mental health difficulties, such as anxiety and depression (Rehm et al., 2015).

Depression

Depression is now considered the most common cause of burden and disability worldwide (Mathers, Boerma, & Ma Fat, 2008). Major depressive disorder is characterised by a persistent low mood or loss of interest, such as a lack of motivation to engage in activities, for instance going out and attending to personal hygiene (National Health Service, 2019). Either of these symptoms are required to persist alongside at least four other characteristics during the same two-week period. Other diagnostic characteristics include feelings of worthlessness, fatigue, and difficulty in thinking (American Psychological Society, 2013). If people are suffering from continuous low mood for a prolonged period this can increase their risk of harm to self and suicide (Gilbert, 2017).

Depression severity can be measured through outcome measures, including the Beck Depression Inventory (Beck, Steer, & Brown, 1996). The tools vary; some tools measure the severity of symptoms of depression on a continuum, other tools use binary classification.

Comorbidity

When a person experiences a comorbid mental health difficulty and substance use difficulty, this is often referred to as a Dual Diagnosis (DD; Klimkiewicz et al., 2015). Some clinicians use this expression to refer to clients with severe mental health problems (e.g. psychosis) and dependent substance use, while others suggest DD is on a continuum, including common mental health problems of anxiety and depression (Hamilton, 2014).

It is well known from previous reviews and studies that heavy alcohol use and symptoms of depression commonly co-occur (Alati et al., 2005). This could be due to alcohol use causing depressive-like side effects, or dependent alcohol use and depression may have common underlying risk factors (Delgadillo, Böhnke, Hughes, & Gilbody, 2016). It can be problematic to determine which difficulty arose first. Some people report drinking alcohol to help regulate their mood; however, the side effects of drinking alcohol can have the opposite effect to the one desired, including increased symptoms of depression (Hilliard, 2019).

Having a DD can have a major impact on a person's quality of life and wellbeing. It is estimated that a third of people with major depression have a comorbid alcohol problem (Robinson, 2018) and up to 85% of people with an alcohol use disorder have a DD (Weaver et al., 2003). It is increasingly difficult for people with a DD to access interventions. The European Monitoring Centre for Drugs and Drug Addiction (EMCDDA; 2016) acknowledge that people with a DD often experience poorer treatment outcomes and are complex to manage.

People who experience a DD are more likely to have difficulties with housing, social issues, medical problems, legal proceedings, and have a greater risk of harm to self (Mueser & Gingerich, 2013). Therefore, it is important to provide an integrated intervention for this client group (Baker & Velleman, 2007). Wider society can also benefit from people with a DD accessing interventions, as there are reductions in crime rates, anti-social behaviour and aggression. This reduces the socio-economic costs and need for health care (Drake & Wallach, 2000). Integrated treatment is

recommended as an intervention for this client group (National Institute for Health and Care Excellence, [NICE], 2016).

When investigating the association between alcohol use and depression severity, it is important to consider the severity of each diagnosis. Multiple studies have reported inconsistent findings between these variables; from no association (Khalid, Kunwar, Rajbhandari, Sharma, & Regmi, 2000), a linear association (Regier et al., 1990), a J shaped association (Li et al., 2019), and a U shaped association (Skogen, Harvey, Henderson, Stordal, & Mykletun, 2009). U and J shaped associations are when those who drink moderately have lower depression severity than low or heavy alcohol users. Therefore, a meta-analysis would be beneficial to combine all the results to view the overall effect and identify any bias or confounders that may occur in the articles. Previous meta-analyses have been conducted; however, they have combined categorical and continuous measures of depression severity (Li et al., 2019). Many mental health services base their inclusion criteria on these variables; therefore, it would be beneficial to summarise the evidence.

The association between depression and alcohol has resulted in diverse findings, which may be due to covariates. A wide range of covariates have been identified, including those more frequently reported; age, education, and marital status, to obscure covariates such as, 'fish and energy intake', (Mihrshahi, Dobson, & Mishra, 2015), and 'religiosity' (Perreira & Sloan, 2002). It is important to consider the impact of any association, especially when delivering interventions.

To the author's knowledge, a meta-analysis has not been conducted to investigate this association using continuous measures of alcohol use/severity and depression severity. The present literature review aimed to identify studies that investigated the association between alcohol use and depression severity on a continuum. The aim was to contribute to the evidence base surrounding the debate and consider if people who drink large amounts of alcohol are more likely to be clinically depressed. A research protocol was developed and pre-registered on Prospero, ID number: CRD42018096548 (Appendix A).

Methodology

To develop the protocol, a PICO (Patient, Intervention, Comparison, Outcome) framework was applied (Huang, Lin, & Demner-Fushman, 2006). This enables clinicians to focus the research question to facilitate the search strategy (Schardt, Adams, Owens, Keitz, & Fontelo, 2007). The target population was defined as adults, in the general population, who have symptoms of depression. An intervention was not applicable to the research question. The comparison was between severity of depression in people with different patterns of alcohol use, and outcome was based on validated, continuous measures of depression severity (Appendix B).

Search strategy

To identify relevant literature, four databases (Scopus, Medline, Psycinfo, and Web of Science) were searched on 06/09/2019 with no pre-defined date limits. Email alerts were monitored for further relevant articles until 29/04/2020. Databases included a range of literature from social and health sciences, including international research.

Databases were accessed via the University of Sheffield's electronic library. A set of search terms were developed, which included: alcohol AND depress* OR low mood OR affective disorder* AND screening tools for depression. The depression measures were sourced using extensive online searches and discussions with professionals. The final list of depression measures and search terms can be found in Appendices C and D.

Selection criteria

The following inclusion criteria were applied; participants' were aged 18 years and older, symptoms of depression were measured using a validated measure of depression, depression measures used a continuous scoring criteria for severity and participants' discussed alcohol intake. These variables were also measured at the same time. This was to gain an overview of the range of depression scores rather than categorical data, and to ensure any association is an accurate reflection of the participant's variables at that time.

Studies were excluded if they only used binary measures of depression, non-empirical studies such as grey literature, due to lack of peer review, and studies that were not written in the English language, as translation services were unavailable.

Screening

The databases were searched and returned 12,660 articles. After duplicates (*n*=1,047) were removed using Endnote (Clarivate Analytics, 2020), the remaining articles (*n*=11,613) were screened for relevance using title and abstract. The remaining articles were assessed using the inclusion and exclusion criteria. Of these 93 articles, nine articles did not measure alcohol use and depression at the same time, 22 articles did not measure alcohol use, 17 articles did not investigate the association between alcohol and depression, one article was not written in the English language, 23 articles treated depression ratings as binary, five articles included minors, three articles did not measure depression, and two articles were grey literature. These 83 articles were excluded, resulting in 10 articles meeting the inclusion criteria.

Forward citation searches and reference list searches were conducted on 09/09/2019 and identified two additional articles meeting inclusion criteria. In addition, the corresponding authors of the 12 papers were emailed and two authors replied (Appendix E). This did not identify any further relevant articles. Figure 1 shows the search strategy in a Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) diagram (Moher, Liberati, Tetzlaff, Altman, & The PRISMA Group, 2009).

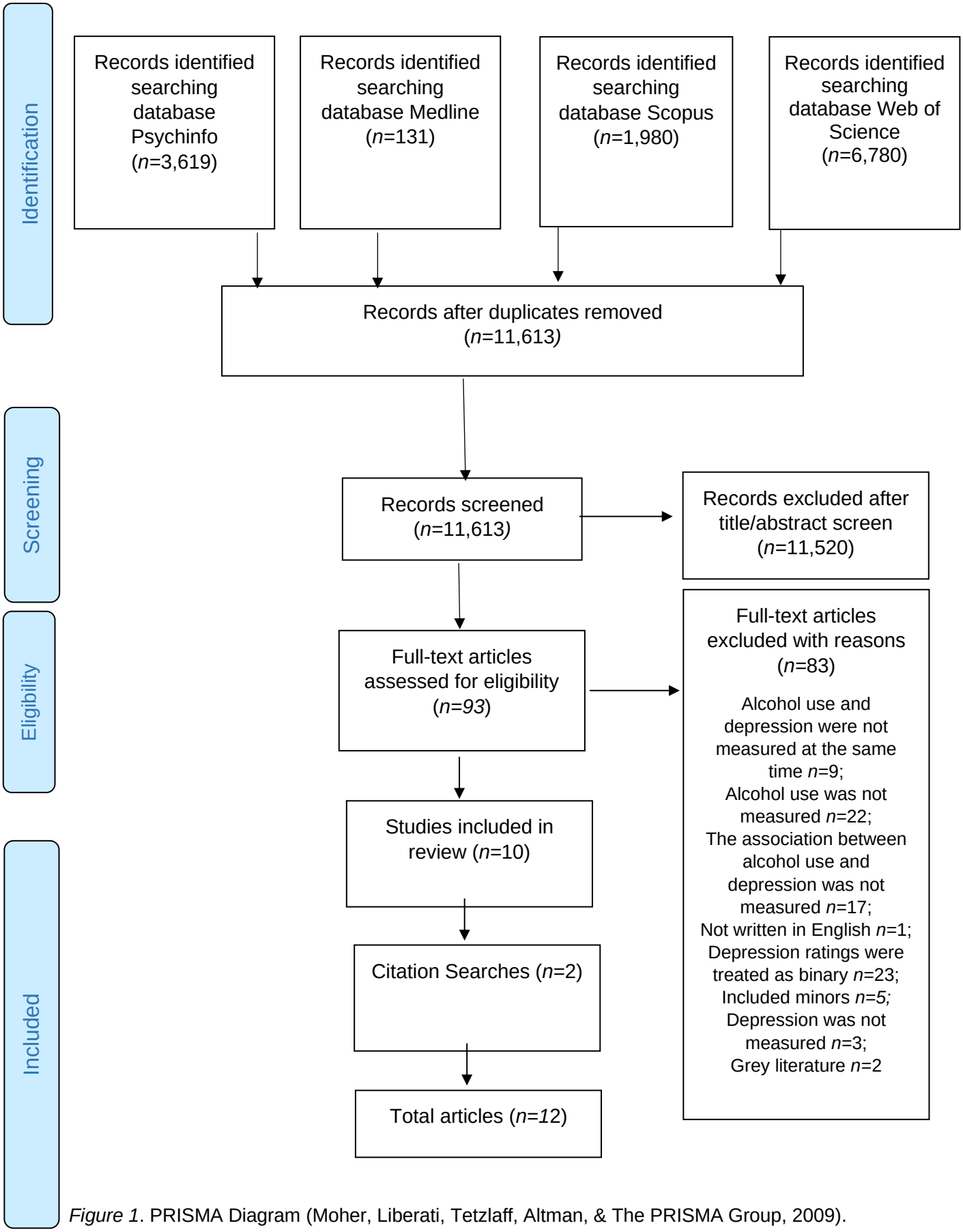

Figure 1. PRISMA Diagram (Moher, Liberati, Tetzlaff, Altman, & The PRISMA Group, 2009).

Data extraction

A data extraction table was developed using the Cochrane Handbook for guidance (Li, Higgins, & Deeks, 2019). The table included; author, date of publication, study design, study setting (population, date of recruitment and country), aim, participant characteristics (age, gender and sample size), measures of depression, measures of alcohol, main findings, reported statistics, covariates and adjusted statistics (Appendix F). If multiple measures of alcohol and depression were identified and the authors had not explicitly referred to a primary measure, this review prioritised the measure which concurred with the majority of other reviewed studies in order to enable comparability.

Critical appraisal

The quality and risk of bias within each article was assessed using appraisal tools to identify the strengths and weaknesses. The Downs and Black 27 item checklist (Downs & Black, 1998; Appendix G) was recommended by the Centre for Reviews and Dissemination (CRD; 2008). Question 27 was modified to; 'does the article include a power analysis?'. This has been altered in numerous studies and the scoring was amended; poor (≤14), fair (15-19), good (20-25), and excellent (26-28), as explained in Hooper, Jutai, Strong, and Russell-Minda (2008).

When reviewing the Downs and Black checklist, multiple questions were not applicable to the final articles. Therefore, the Critical Appraisal Skills Checklist (CASP; 2018) for cohort studies was considered and deemed appropriate (Appendix H). The CASP is a 12-item checklist and highly rated tool, developed by experts in the field to assess the quality of an article (CASP, 2018).

The articles were independently rated by a researcher to test for reliability and to avoid bias (Price, Jhangiani, & Chiang, 2015). The inter-rater reliability was calculated using Kappa, which ranges from -1 to +1. The score can be interpreted as: ≤0–0.20 no agreement, 0.21–0.39 minimal agreement, 0.40–0.59 weak agreement, 0.60–0.79 moderate agreement, 0.80–0.90 strong agreement, and >0.90-1.00 almost perfect agreement. It is recommended that there is at least 80% agreement between raters for reliability (McHugh, 2012).

The authors do not recommend scoring the CASP, however, to allow comparison between raters the checklists were quantified**.** Some items were reduced to a dichotomy for scoring purposes following a discussion with the peer rater. Therefore, the scores on the CASP ranged from 0-28, with each item scoring zero points for 'no', one point for 'can't tell', and two points for 'yes'. Higher scores indicate less risk of bias and higher quality. As both tools were scored out of 28, the Downs and Black scoring ranges were used to compare the articles.

Meta-analysis

A meta-analysis was conducted to investigate the association of alcohol use and depression severity. The author considered a scoping review, however a meta-analysis is a more robust method for analysing research, as we already have a pre-existing knowledge base. The articles also include statistical data that is suitable for a meta-analysis to be conducted (Peterson, Pearce, Ferguson, & Langford, 2017). The meta-analysis provides an estimate of the combined effect size from multiple articles. This is presented as a weighted mean of the effect size, taking into account the sample size (Field, 2006). The meta-analysis was conducted using an online software

package, Meta-Analysis Via Shiny V1.1.3 (MAVIS; Hamilton, Aydin, & Mizumoto, 2016).

To carry out the meta-analysis, a random effects Hunter-Schmidt (1990) raw correlation coefficient was used. This was to reduce the risk of a type one error when compared to the Hedges-Olkin (1985) Fisher Z transformation (Stats Direct, 2020). The random effects model was selected as it is highly likely that study samples were highly heterogeneous and the effect size of each article may vary due to the natural variance in the sample (Borenstein, Hedges, Higgins, & Rothstein, 2009).

The effect size was extracted from the articles, and online calculators (DeCoster, 2012) were used to convert effect sizes into the correlation coefficient, r. This is a widely known and used metric to measure correlations between two continuous variables. It is also known for being a versatile measure of the strength of an association (Field, 2006). The correlation coefficient can range from -1 to +1. Effect size can be interpreted as: 0.2=small, 0.5=medium, and 0.8=large (Cohen, 1988). The results are presented to a 95% confidence interval and *p* values of ≤0.05 would indicate a statistically significant result, which is common practice in research methods (Hak, van Rhee, & Suurmond, 2018).

Due to the small number of papers, a series of sensitivity analyses were conducted to systematically remove the heterogeneity, to view the influence on the pooled effect size (Rubio-Aparicio, Sánchez-Meca, López-López, Botella, & Marín-Martínez, 2017). The variables included gender, study design, alcohol measure,

depression measure, adjusted statistics that include confounding variables, and quality of articles. These variables were selected as they were the main key differences between the articles.

Heterogeneity

To assess the heterogeneity and variance within the samples, the Q-statistic and I^2 statistics were analysed. The Q-statistic measures variation around the average, with a significant Q indicating variance within the sample (Hak et al., 2018). The I^2 measures the variance in the sample due to heterogeneity, rather than what would be expected by chance (Higgins, Thompson, Deeks, & Altman, 2003). If the Q-statistic is statistically significant, the I^2 score will be interpreted to view the amount of heterogeneity. I^2 scores are expressed as a percentage: 25-50% little different, 50-75% quite different, and 75-100% considerably different (Hamilton et al., 2016).

After conducting the primary meta-analysis, a moderator analysis was performed to examine potential sources of unexplained heterogeneity (Hak et al., 2018). The variables analysed in the moderator analysis included depression measures, alcohol use measures, and risk of bias ratings, as these were some of the most evident sources of heterogeneity across the included studies.

Publication bias

Publication bias can occur as studies that yield statistically significant results have a higher rate of publication than studies with non-significant results (Jüni 2002).

Publication bias can be detected by a visual inspection of the funnel plot. An asymmetrical funnel plot indicates some studies are missing, and publication bias is evident (Simmonds, 2015). To determine the effect of publication bias, the Egger's test was conducted; if the result is significant, this indicates publication bias (Egger, Smith, Schneider, & Minder, 1997).

The fail-safe N was calculated using the Rosenthal Approach (Rosenthal, 1979). This calculation indicates the number of studies with a null finding that would be required to change the statistical significance of the results (Oswald & Plonsky, 2010).

Results

A total of 12 articles were identified, using 11 independent samples. Therefore, to run the meta-analysis, one article was removed (Lipton, 1997), which used a smaller and more restricted sample of only male participants when compared to Golding, Burnham, and Wells (1990). The final number of effect sizes included in the primary analysis was *k*=11. The findings from; data extraction, critical appraisal, meta-analysis, sensitivity analysis, heterogeneity, moderator analysis, and publication bias, will be discussed.

Data extraction

Participant characteristics are provided in table 1. Of the 12 articles, 11 used an observational design and one study used a randomised control trial. The countries studied varied, including United Kingdom, Australia, America, South Korea, and

Slovakia. Data was gathered from multiple time points ranging from 1980-2010. The study settings included inpatient services, outpatient services, university students, and community residents.

From the available data, a total of *n*=17,366 participants were studied, including *n*=10,209 female participants and *n*=6,936 male participants, aged between 18-105 years.

Depression measures

When analysing the data, four continuous measures of depression were identified as moderators. Measures based on the same outcome measure were collated for analysis purposes; for example, depression measures that had been modified, or translated into different languages.

The Beck Depression Inventory (BDI: Beck, Steer, & Brown, 1996) moderator included six articles (King, Bernardy, & Hauner, 2003; Pavkovic et al., 2018; El Ansari, Sebena, & Stock, 2013; Sebena, El Ansari, Stock, Orosova, & Mikolajczyk, 2012; Kim, Kim, Morris, & Park, 2015; Palfai, Cheng, Coleman, Bridden, Krupitsky, & Samet, 2014), analysing four depression questionnaires; BDI 21-item (Beck, Steer, Ball, & Ranieri, 1996), BDI-Modified (Beck et al., 1996), Korean BDI-21 item (Beck, 1967) and Russian BDI-21 item (Beck, 2007). The BDI-21 item, BDI-Modified, Korean-BDI and Russian-BDI were valid and reliable tools for measuring depression (Wang &

Gorenstein, 2013; Reynolds & Gould, 1981; Lee et al., 1995; Beck, Steer, & Brown, 1996).

The Center for Epidemiologic Studies Depression Scale (CES-D) moderator collated the 11 and 20 item versions of the CES-D (Radloff, 1977), across three articles (Choi & DiNitto, 2011; Golding, Burnham, & Wells, 1990; Sullivan et al., 2008). Both versions of the CES-D are reliable and valid tools to measure depression (Kohout, Berkman, Evans, & Cornoni-Huntley, 1993).

The remaining two articles used different measures of depression. Caldwell et al. (2001) used the Goldberg Depression Scale (Goldberg, 1993), an 18-item measure that is a reliable and valid tool for assessing people with depression (Holm, Holm, & Bech, 2001). The remaining depression measure was the Hamilton depression rating scale (HAM-D); a 21-item questionnaire (Hamilton, 1960) referred to in Park et al. (2015). This tool was translated into Korean and found to be valid and reliable for use with people with depression (Yi et al., 2005).

Alcohol measures

Various alcohol measures were identified within the articles. Some of the measures were similar and therefore grouped together for the moderator analysis. The first moderator included the Alcohol Use Disorders Identification Test (AUDIT; Babor, de la Fuente, Saunders, & Grant, 1992) in English and Korean; this was used in three articles (Caldwell et al., 2001; Kim et al., 2015; Park, et al., 2015). Korean culture

specific cut offs for measuring alcohol use were used as relevant. The AUDIT is a 10-item questionnaire to assess a person's difficulties with alcohol. This is a reliable and valid tool to identify people with alcohol difficulties (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001). Scores range from 0-40, and scores of eight and above are considered to indicate harmful alcohol use in an English population, and 12 and above in a Korean population (Kim, Yum, Lee, & Yoon, 1995).

Five articles used a quantity moderator (Golding et al., 1990; Choi & DiNitto, 2011; King et al., 2003; Sullivan et al., 2008; Palfai et al., 2014). Choi and DiNitto (2011), Golding et al. (1990), Sullivan et al. (2008) and Palfai et al. (2014), used the quantity of alcoholic drinks; per drinking day, per day, past month, and last 30 days, respectively. In Palfai et al. (2014) the formal tool of the Alcohol Timeline Followback Method (TLFB; Sobell & Sobell, 1992) was used. Participants retrospectively estimated their total number of heavy drinking days and number of drinks per day using a calendar, which was found to be a reliable measure for obtaining alcohol data (Sobell, Brown, Leo, & Sobell, 1996). The final article, King et al. (2003) created a quantity frequency index, which combined the number of drinks and frequency of drinking alcohol into three categories: alcohol dependent, problematic/heavy drinkers, and light social drinkers.

The next moderator, CAGE, is a four-item questionnaire, and an acronym of the key issues; Cut down, Annoyed by criticism, Guilty, and Eye opener (Ewing, 1984). The tool aims to assess alcohol problems, scores range from 0-4, and problem drinking is defined as a score of two or more. This tool is valid and reliable for identifying alcohol difficulties. Limitations were identified in assessing alcohol

difficulties in white females, college students, and pre-natal females (Dhalla & Kopec, 2007). Two articles (El Ansari et al., 2013; Sebena et al., 2012) used the CAGE.

The final article (Pavkovic et al., 2018) used the Michigan Alcoholism Screening Test (MAST; Selzer, 1971). This is a 25-item measure to assess people's difficulties with alcohol; scores range from 0-50 and are classified into categories; 0-2 no apparent problem, 3-5 early or middle problem drinking, and ≥6 problem drinking. This is a reliable and valid tool for measuring alcohol difficulties (Allen & Columbus, 2003).

Table 1

Data Extraction

Author (Date)	Design	Study setting	Participant characteristics	Primary measure of depression	Primary measure of alcohol	Main findings	Covariates	Quality rating	Effect size
El Ansari, Sebena, & Stock (2013)	Obs	Undergraduate students from seven universities England, Wales & Northern Ireland 2007-2008	n=3,220 Male: n=692, female: n=2528 Mean age 22.2-31.6 years old	Modified BDI	CAGE	Depressive symptoms were associated with problem drinking and possible alcohol dependence for both genders, after controlling for covariates	Gender, age, university, having an intimate relationship, & accommodation during the semester	Excellent	0.10
Caldwell, Rogers, Jorm, Christensen, Jacomb, Korten, & Lynskey (2001)	Obs	Community residents, path through life project Canberra, Australia March 1999-February 2000	n=2404 Male: n=1096, female: n=1180 20-24 years old	GDS	Weekly consumption	Depression is significantly related to overall alcohol consumption in males after adjusting for covariates. Compared to the light drinkers, both the non/occasional drinkers, and the hazardous/harmful drinkers had significantly higher depression scores in male participants. Females had higher levels of depression and negative affect was associated with hazardous/harmful alcohol consumption	Current tobacco use, current marijuana consumption, past hazardous/harmful drinking levels, physical health, financial hardship, stressful life events, adverse childhood events, support from family and friends, education, personality, & behavioural style	Good	0.06
Choi & DiNitto (2011)	Obs	Community residents, National Social Life, Health and Aging Project (NSHAP) USA 2005-2006	n=2924 Male: n=1410, female n=1514 57-85 years old	CES-D 11 item	Quantity (average number of drinks consumed on a drinking day)	Regression results showed that for males heavy/binge drinking was significantly positively associated with depression severity. There was no association between alcohol use and symptoms of depression in females	Sociodemographic characteristics, health status, social support, & health-related variables	Good	0.07

Author (Date)	Design	Study setting	Participant characteristics	Primary measure of depression	Primary measure of alcohol	Main findings	Covariates	Quality rating	Effect size
Golding, Burnham, & Wells (1990)	Obs	Community residents and in-patient mental health services, Los Angeles Epidemiologic Catchment Area study Los Angeles, USA 1980-1985	n=2393 Male: n=1110, female: n=1222 Aged >18 years old	CES-D 20 item	Quantity (average number of drinks per day)	In male and females, depression scores and alcohol use were positively associated until covariates were controlled for	Gender, age, income, household size, education, marital status & employed	Excellent	0.06
Kim, Kim, Morris, & Park (2015)	Obs	Community residents. Gangneung, South Korea 2002-2007	n=1819 Male: n=638, female: n=1175 60-105 years old	Korean BDI 21 item	AUDIT	AUDIT total score was significantly associated with higher depression scores in both a linear and quadratic pattern. Once the data was adjusted for covariates a J shaped curve was observed. Abstainers and problem drinks were at higher risk of depression. Among non-problem drinkers the effect of alcohol use was negatively related to depression, however for problem drinkers an increased alcohol use was associated with higher levels of depression after controlling for covariates	Age, smoking status, exercise, marital status, physical health & mental health	Good	0.08

Author (Date)	Design	Study setting	Participant characteristics	Primary measure of depression	Primary measure of alcohol	Main findings	Covariates	Quality rating	Effect size
King, Bernardy, & Hauner (2003)	Obs	Alcohol treatment centres and community residents USA Date unavailable	n=154 Male: n=83, female: n=71 18-51 years old	BDI 21 item	Quantity-frequency Index	Participants who are alcohol dependent reported significantly more symptoms of depression, when compared to problematic drinkers and light social drinkers. Females reported significantly more depressive symptoms when compared to males in the alcohol dependent and problematic drinking categories	Gender	Good	0.99
Lipton (1997)	Obs	Community residents and in-patient mental health services Los Angeles, USA 1980	n=1,444 Male: n=1,144, female: n=0 Aged > 18 years old	CES-D 20 item	Quantity and frequency classification	Non-Hispanic white males have a U-shaped association with alcohol use and depression severity, as moderate drinkers have lower levels of depression than heavy drinkers and abstainers. There was no association between depression severity and alcohol use in Mexican American males born in America. Mexican American males born in Mexico had a J-shaped curve with abstainers-moderate drinkers having fewer symptoms of depression when compared to heavy drinkers	Age, gender, socioeconomic status, education, & self-reported physical health status	Excellent	0.06

Author (Date)	Design	Study setting	Participant characteristics	Primary measure of depression	Primary measure of alcohol	Main findings	Covariates	Quality rating	Effect size
Palfai, Cheng, Coleman, Bridden, Krupitsky, & Samet (2014)	RCT	4 inpatient and outpatient HIV and narcology (i.e. addiction treatment) care sites, HERMITAGE Trial (HIV's Evolution in Russia-Mitigating Infection Transmission and Alcoholism in a Growing Epidemic) St. Petersburg, Russia October 2007-April 2010	n=700 Male: n=415, female: n=285 18-70 years old	Russian BDI 21 item	30 day time-line follow back	When controlling for covariates, depressive symptoms was significantly associated with alcohol use	Age, gender, alcohol use, & injection drug use in last 6 months	Good	0.08
Park, Lee, Oh, Jun, Lee, Kim, Kim, Yim, & Park (2015)	Obs	16 university affiliated hospitals and 2 general hospitals, Clinical Research Centre for Depression study (CRESCEND) for people on psychopharmacological treatment for depression Korea January 2006-August 2008	n=402 Male: n=151, female: n=251 Mean age 42.6 years old	HAMD	Korean AUDIT	Participants who are classed as hazardous drinkers experience more depressive symptoms than non-hazardous drinkers	Age & gender	Good	0.05
Pavkovic, Zaric, Markovic, Klacar, Huljic, & Caricic (2018)	Obs	Health Centre Čukarica, Belgrade, Serbia March-September 2017	n=421 Male: n=175, female: n=246 19-65 years old	BDI 21 items	MAST	Alcohol use showed a positive association with depressive symptoms, after controlling for confounders	Gender	Fair	0.77

Author (Date)	Design	Study setting	Participant characteristics	Primary measure of depression	Primary measure of alcohol	Main findings	Covariates	Quality rating	Effect size
Sebena, El Ansari, Stock, Orosova, & Mikolajczyk (2012)	Obs	University freshmen sample Germany, Poland, Bulgaria, UK & Slovakia Germany, Poland & Bulgaria -May 2005, UK -May 2007 & Slovakia - May 2008	n=2,503 (Germany: n=654, Poland: n= 561, Bulgaria: n=688, UK: n=311 & Slovakia: n=315) Male: n=866, female: n=1,637 Mean age 20.37 years old	Modified BDI	CAGE	Depression symptoms were associated with problem drinking after adjusting for gender, country, perceived sufficiency of income and importance of religious faith	Gender, country, perceived sufficiency of income, & importance of religious faith	Good	0.06
Sullivan, Saitz, Cheng, Libman, Nunes, & Samet (2008)	Obs	Specialist HIV clinics and health care centres, HIV-Longitudinal Interrelationships of Viruses and Ethanol study (HIV-LIVE) USA August 2001-July 2003	n=400 Male: n=300, female: n=100 21-71 years old	CES-D 20 item	Past month alcohol consumption in units	Alcohol use is associated with more depressive symptoms in HIV-infected patients before controlling for confounders. After the adjustment for confounders, this is no longer significant	Age, gender, race, homelessness, hepatis c virus antibody status, Katz comorbidity scale, past month illicit drug use, antiretroviral therapy medication use and adherence, CD4 cell counts, HIV log RNA, & time in months since study enrolment.	Good	0.08

Notes:

Design: OBS – Observational Study; RCT- Randomised Controlled Trial.

Measures of alcohol: AUDIT - Alcohol Use Disorder Identification Test; MAST - Michigan Alcoholism screening test; CAGE: Cut down, Annoyed by criticism, Guilty, and Eye opener.

Measures of depression: CES-D - Centre for Epidemiological Studies -Depression; BDI - Beck Depression Inventory; HAMD - Hamilton Depression Rating Scale; GDS - Goldberg Depression scale.

Risk of bias assessment

The Downs and Black checklist was used to rate the methodological quality of Palfai et al. (2014), a randomised controlled trial. The remaining 11 articles were observational in nature and the quality was assessed using a Cohort checklist (CASP, 2018; Appendix I).

A research peer independently rated all 12 articles (Appendix J). There was an agreement on the methodological quality of 10 articles. This indicated a Kappa score of 0.83, showing a very high rate of agreement and reliability of the quality ratings, therefore a third reviewer was not required (McHugh, 2012). Discussions were held until there was a consensus on all 12 articles. As shown in Appendix K, the raters agreed that three articles were of excellent quality (El Ansari et al., 2013; Lipton, 1997; Kim et al., 2015), eight articles were good quality (Caldwell et al., 2001; Sebena et al., 2012; Golding et al., 1990; Choi & DiNitto, 2011; King et al., 2003; Palfai et al., 2014; Park et al., 2015; Sullivan et al., 2008), and one article was of fair quality (Pavkovic et al., 2018).

The articles of excellent methodological quality had a clearly focussed issue, recruited participants in an appropriate manner, identified confounding factors, included confounder factors in the analysis, and appropriately reported the statistics and the relevance to existing evidence, alongside the clinical implications. When exploring the limitations of the articles, Lipton (1997) was not able to apply the results to a wider population and Golding et al. (1990) failed to report confidence intervals.

The articles of good methodological quality clearly described the issue, considered confounding variables and described the results in detail. The articles had different limitations; for example, some lacked detail in participant recruitment and did not adequately take confounding variables into consideration (Choi & DiNitto, 2011; Park et al., 2015). Kim et al. (2015) failed to report confidence intervals, and Choi and DiNitto (2011) and Palfai et al. (2014) lacked an explanation about minimising research bias. All eight articles were limited in their ability to generalise the results to a wider population, and Sullivan et al. (2008) did not consider any clinical implications of the findings.

The final article, of fair methodological quality, clearly addressed a focussed issue, and attempted to control for bias. The results were reported appropriately, however they lacked precision, including the confidence intervals. The cohort was recruited in a restricted manner and was not representative of a wider population. The research was limited as gender was the only confounding variable considered.

Meta-analysis

The primary meta-analysis, k=11, explored the linear association between alcohol use and depression severity. The effect sizes ranged from r=0.05-0.76.

The forest plot as seen in figure 2 illustrates the pooled weighted mean effect size, r=0.22, (0.02-0.39), p<0.01, indicating a small positive correlation between alcohol use and depression severity.

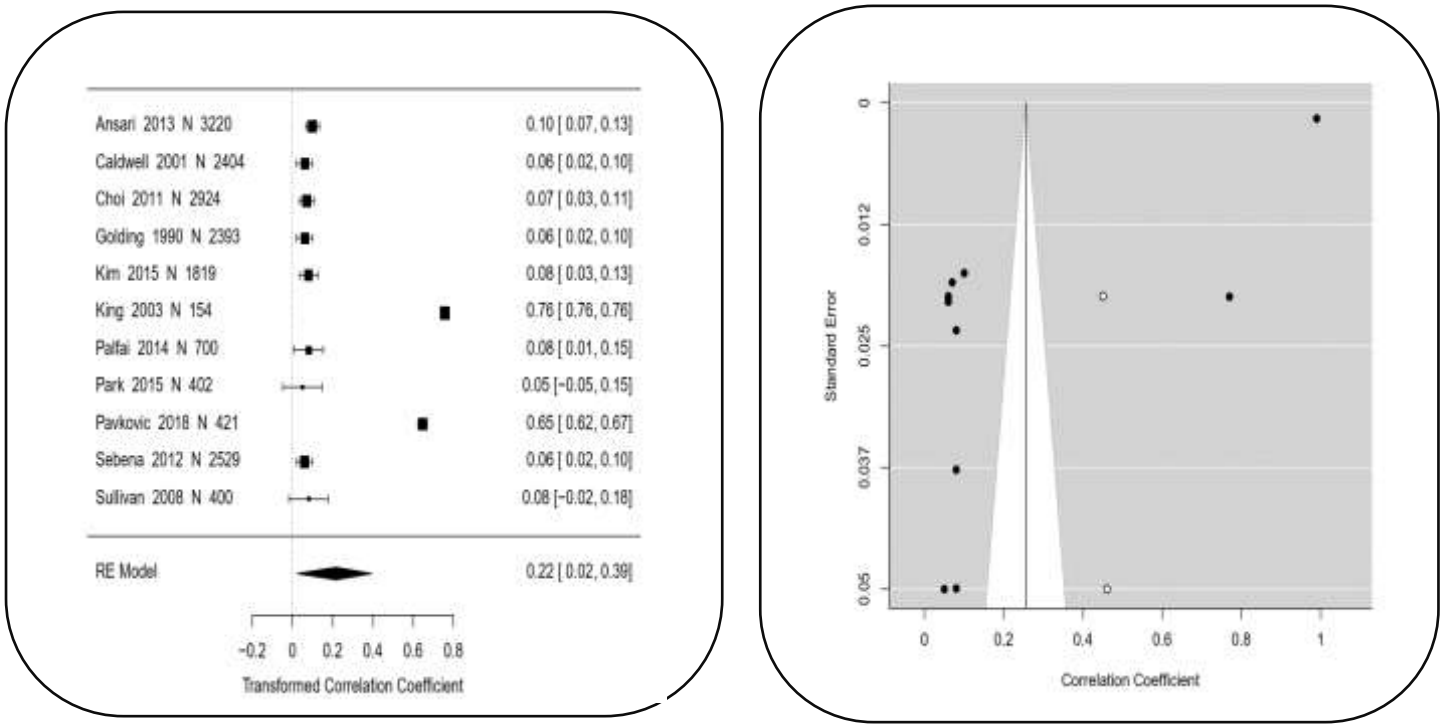

Figure 2. Forest plot and funnel plot for primary meta-analysis

Heterogeneity

The Q-statistic results indicated significant heterogeneity, Q(10)=1,344.10, p<0.01, therefore, the I^2 was calculated. This resulted in 99.3% heterogeneity, implying that the articles are considerably different. This could be due to the different approaches for measuring variables of depression severity and alcohol use. However, caution must be taken when interpreting the results.

Moderator analysis

Due to the large amount of heterogeneity in the meta-analysis, a moderator analysis was carried out to view how much of the heterogeneity was accounted for by the moderators of alcohol measure, depression measure and risk of bias ratings.

Alcohol measure

When conducting a moderator analysis for alcohol measure (see table 2), the studies using alcohol quantity measures produced a small significant correlation coefficient, r=0.21, (-0.07-0.19), p<0.01, however as the confidence interval crosses the null line, this indicates no effect. The MAST measure had a medium effect size and significant correlation with depression severity, r=0.65, (0.12-0.49), p=<0.01; however, this moderator analysis only included one study. The moderators CAGE and AUDIT found a small effect size, and the results were not of statistical significance, as r=0.07, (-0.08-0.23), p=0.31 and r=0.06, (-0.68-0.19), p=0.33 respectively. Therefore, the MAST measure moderated the association between depression severity and alcohol use, although these results should be viewed with caution as this moderator only includes one article.

The between-groups heterogeneity test indicated there is still a large amount of heterogeneity and found a significant difference between the subgroups; $Q_{Between}$=27.27, df=4, p<0.01. This suggested the effect sizes across the moderators differ by more than what would be expected by sampling error (Card, 2012).

Depression measure

When conducting a moderator analysis for depression measures (see table 3) the BDI moderator had a small significant correlation coefficient, r=0.31, (0.18-0.44), p<0.01, indicating that BDI and alcohol use are correlated. The CES-D, GDS and HAMD all had a small effect size when investigating the correlation with alcohol use,

which was not of statistical significance; r=0.07, (-0.13-0.27), *p*=0.46, r=0.06, (-28-0.39), *p*=0.63, and r=0.05, (-0.29-0.39), *p*=0.66 respectively.

Overall, the $Q_{between}$=5.77, df=3, *p*=0.12 indicated that the moderators did not significantly explain the variance. Therefore, depression measure is not a moderator of the association between depression severity and alcohol use.

Risk of bias and methodological quality ratings

When conducting a moderator analysis on methodological quality ratings (see table 4) the articles of excellent quality showed a small correlation coefficient, which was not of statistical significance; r=0.08, (-0.06-0.22), *p*=0.27. Fair quality articles showed a medium effect size and significant positive correlation; r=0.65, (0.50-0.76), *p*<0.01. However, this variable only included one article. Good quality articles indicated a small significant correlation coefficient; r=0.15, (0.07-0.22), *p*<0.01.

Overall, the $Q_{between}$=29.93, df=2, *p*<0.01, indicated a large amount of heterogeneity and statistically significant differences between the subgroups. This would suggest that effect sizes across the moderators differ by more than what would be expected by sampling error (Card, 2012).

Conclusion

Within the primary meta-analysis, there was a large amount of heterogeneity, and therefore the results should be interpreted with caution (Card, 2012). A moderator analysis indicated that some of the heterogeneity was accounted for by alcohol measure and article quality.

Publication bias

To examine the publication bias within the primary meta-analysis a funnel plot was generated to view the effect sizes, as shown in table 2. Following a visual analysis, the funnel plot appeared to be asymmetrical around the mean effect size. The Eggers test for funnel plot asymmetry confirmed the visual finding and indicated potential publication bias: $t(9)=-6.76$, $p<0.01$.

The fail-safe N revealed that 171,227 studies with a null finding would be required to change the statistical significance of the result.

Table 2

Alcohol measure as a moderator

Moderator	*n*	k	Estimate	Variance	SE	Lower confidence interval	Upper confidence interval	Z	*p*	Q	df	p.h	I^2
1 AUDIT	4,625	3	0.06	0.00	0.07	-0.07	0.19	0.74	0.33	0.53	2	0.76	0%
2 CAGE	5,749	2	0.08	0.01	0.08	-0.08	0.23	0.76	0.31	2.26	1	0.13	56%
3 MAST	421	1	0.65	0.01	0.12	0.49	0.77	1.00	0.00	0.00	0	1.00	NA
4 Quantity	6571	5	0.21	0.00	0.05	0.11	0.31	0.99	0.00	125.73	4	0.00	97%
5 Overall	17,366	11	0.18	0.00	0.04	0.12	0.26	1.00	0.00	323.63	10	0.00	97%

Heterogeneity	Q	Qw	Qw.df	Qw.p	Qb	Qb.df	Qb.p
1	323.63	128.54	7	0	195.09	3	0.00

Table 3

Depression measure as a moderator

Moderator	*n*	k	Estimate	Variance	SE	Lower confidence interval	Upper confidence interval	z	*p*	Q	df	p.h	I^2
1 BDI	8,843	6	0.31	0.01	0.07	0.18	0.44	0.99	0.00	304.45	5	0.00	98%
2 CES-D	5,717	3	0.07	0.01	0.10	-0.13	0.27	0.59	0.46	0.21	2	0.90	0%
3 GDS	2,404	1	0.06	0.03	0.18	-0.28	0.39	0.32	0.63	0.00	0	1.00	NA
4 HAMD	402	1	0.05	0.03	0.18	-0.30	0.39	0.27	0.66	0.00	0	1.00	100%
5 Overall	17,366	11	0.20	0.00	0.05	0.10	0.30	0.99	0.00	323.63	10	0.00	97%

Heterogeneity	Q	Qw	Qw.df	Qw.p	Qb	Qb.df	Qb.p
1	323.63	304.66	7	0	5.77	3	0.12

Table 4

Methodological quality of article as a moderator

Moderator	*n*	K	Estimate	Variance	SE	Lower confidence interval	Upper confidence interval	z	*p*	Q	df	p.h.	I^2
1 Excellent	5,613	2	0.08	0.01	0.07	-0.06	0.22	0.80	0.27	2.19	1.00	0.14	54%
2 Fair	421	1	0.65	0.01	0.11	0.50	0.76	1.00	0.00	0.00	0.00	1.00	NA%
3 Good	11,332	8	0.15	0.00	0.04	0.07	0.22	1.00	0.00	127.66	7.00	0.00	95%
4 Overall	17,336	11	0.19	0.00	0.03	0.12	0.25	1.00	0.00	323.63	10.00	0.00	97%

Heterogeneity	Q	Qw	Qw.df	Qw.p	Qb	Qb.df	Qb.p
1	323.63	129.86	8	0	29.93	2	0

Notes: SE: Standard error; df: Degrees of freedom; Qw: Q within; Qb; Q between

Sensitivity analysis

To explore the data further, sensitivity analyses were conducted. Sensitivity analyses were decided *a priori*, to group together certain characteristics following data extraction. Sensitivity analysis included: effects of gender, study design, adjusted statistics that include confounding variables, and quality of articles. Forest plots and funnel plots are available in Appendix L.

Gender

The first sensitivity analyses explored the effect of gender; see table 5. The articles were grouped into those that pooled gender and those that split gender, and separate analyses were conducted. A further analysis was conducted on articles that split gender, to view the effect size on each gender.

A total of five articles split gender into male and female (El Ansari et al., 2013; Caldwell et al., 2001; Choi & DiNitto, 2011; Golding et al., 1990; Pavkovic et al., 2018). The sample size for male and female participants was estimated based on the percentage of total male and female participants provided in Golding et al. (1990).

When exploring the articles that separated gender, the forest plot indicated that the pooled weighted mean effect size was r=0.20, (-0.09-0.45), $p<0.01$. As the confidence interval crosses the null line, this indicates no effect for females. This was similar for males, r=0.22, (-0.03-0.44), $p<0.01$ and the overall effect size for the whole sample of split gender, r=0.21, (-0.06-0.45), $p<0.01$. When exploring the articles that pooled gender (Kim et al., 2015; Palfai et al., 2014; Park et al., 2015; El Ansari et al.,

2013; Sullivan et al., 2008), r=0.22, (-0.08-0.48), p<0.01, again crossing the null line of no effect. The sensitivity analysis indicated that when separating the effects of gender, the meta-analysis no longer indicated an association between the alcohol use and depression severity. When analysing the results in the primary meta-analysis, the results are significant, which could be due to the combined number of studies included and large number of participants, as care has to be taken when using a small number of studies within a sensitivity analysis (CRD, 2009).

The heterogeneity for gender was assessed. The Q-statistic showed evidence of heterogeneity within the results for the categories of females, males, pooled and split, see table 5. Therefore, the results indicated significant heterogeneity within the articles and the I^2 was interpreted. This indicated a large amount of heterogeneity, showing that the effect sizes are considerably different across the studies. Therefore, caution must be taken when interpreting the results.

To assess for publication bias in the female meta-analysis results, a funnel plot was generated to view the effect sizes. Following a visual analysis, the funnel plot appears to be asymmetrical around the mean effect size, however the Egger's test for funnel plot asymmetry did not indicate publication bias: t(3)=-0.16, p=0.88, which confirms symmetry of the funnel plot. The fail-safe N revealed that 623 studies with a null finding would be required to change the statistical significance of the result.

To assess for publication bias in the male meta-analysis results, a funnel plot was generated. Following a visual analysis, the funnel plot appears to be asymmetrical

around the mean effect size, however the Egger's test for funnel plot asymmetry did not indicate publication bias: t(3)=0.93, *p*=0.42, which confirms symmetry of the funnel plot. The fail-safe N revealed that 412 studies with a null finding would be required to change the statistical significance of the result.

When exploring the data for the articles that split gender, a funnel plot was generated to view the effect sizes to assess publication bias. Following a visual analysis, the funnel plot appears to be asymmetrical around the mean effect size; however, the Egger's test for funnel plot asymmetry did not indicate publication bias: t(3)=0.43, *p*=0.69, which confirms symmetry of the funnel plot. The fail-safe N revealed that 1,081 studies with a null finding would be required to change the statistical significance of the result.

To assess for publication bias in the articles that pooled gender, a funnel plot was generated to view the effect sizes. Following a visual analysis, the funnel plot appears to be asymmetrical around the mean effect size. The Egger's test for funnel plot asymmetry confirmed the visual finding and indicated potential publication bias: t(4)=-4.79, *p*<0.01, which confirms asymmetry of the funnel plot. The fail-safe N revealed that 145,095 studies with a null finding would be required to change the statistical significance of the result.

Table 5

Sensitivity analysis for gender

Variable	*n*	k	COR	95%_CI	Heterogeneity Q	df	*p*	I^2
Female	6,722	5	0.20	(-0.09-0.45)	244.35	4	<0.01	98.40%
Male	4,512	5	0.22	(-0.03-0.44)	124.35	4	<0.01	96.80%
Split	11,362	5	0.21	(-0.06-0.45)	363.28	4	<0.01	98.90%
Pooled	6,004	6	0.22	(-0.08-0.48)	978.38	5	<0.01	99.50%

Notes: COR: Correlation coefficient; CI: Confidence interval; df: Degrees of freedom

Study design

The next sensitivity analysis investigated the effect of study design, one article was removed as it was a randomised controlled trial (Palfai et al., 2014), leaving 10 articles using an observational design. The results, r=0.23, (0.02-0.42), p<0.01, indicated a small significant correlation. The heterogeneity was high, Q(9)=1,343.06, *p*<0.01 and indicated an I^2 of 99.3%, suggesting a large amount of heterogeneity in the sample. The results are similar to the primary meta-analysis and therefore the results do not appear to be biased by study design.

To assess for publication bias, a funnel plot was generated to view the effect sizes. Following a visual analysis, the funnel plot appears to be asymmetrical around the mean effect size. The Egger's test for funnel plot asymmetry confirmed the visual finding and indicated potential publication bias: t(8)=-6.48, *p*<0.01, which confirms asymmetry of the funnel plot. The fail-safe N revealed that 170,208 studies with a null finding would be required to change the statistical significance of the result.

Adjustment for covariates

A sensitivity analysis was conducted to investigate the effect of the articles that adjusted the study results to include covariates. One article was removed (Park et al., 2015), leaving 10 articles using adjusted statistics within the analysis. The results indicated r=0.23, (0.02-0.42), $p<0.01$, suggesting a small significant correlation. The heterogeneity was high, Q(9)=1,342.21, $p<0.01$ and indicated an I^2 of 99.3%, suggesting a large amount of heterogeneity in the sample. The results are similar to the primary meta-analysis, and therefore do not appear to be biased by an article adjusting for covariates.

To assess for publication bias, a funnel plot was generated to view the effect sizes. Following a visual analysis, the funnel plot appears to be asymmetrical around the mean effect size. The Egger's test for funnel plot asymmetry confirmed the visual finding and indicated potential publication bias: t(8)=-6.90, $p<0.01$, which confirms asymmetry of the funnel plot. The fail-safe N revealed that 170,773 studies with a null finding would be required to change the statistical significance of the result.

Methodological quality

The next sensitivity analyses explored the quality of the articles. Two articles were of excellent quality (El Ansari et al., 2013; Golding et al., 1990). The results, r=0.08, (0.04-0.12), $p<0.01$, indicated a small significant correlation. The heterogeneity was significant, Q(1)=2.22, $p=0.01$, and I^2 was 55%, suggesting that the articles are quite different and heterogeneous. A significant association between

depression severity and alcohol use was also found in the article of fair quality (Pavkovik, et al., 2018), r=0.65, (0.62-0.67), p<0.01.

Further to these, eight articles were of good quality (Choi & DiNitto, 2011; King et al., 2003; Palfai et al., 2014; Park et al., 2015; Sullivan et al., 2008; Caldwell et al., 2001; Kim et al., 2015; Sebena et al., 2012). The results indicated r=0.36, (0.15-0.54), p<0.01. The heterogeneity was significant, Q(7)=9,991.86, p<0.01 and I^2 was 99.3%, suggesting that the articles are considerably different. These results are congruent with the primary meta-analysis and therefore the results do not appear to be biased by study design. Due to the small number of studies used within the sample, publication bias and fail-safe N were not calculated for articles of fair and excellent quality.

To assess for publication bias in articles of good quality, a funnel plot was generated to view the effect sizes. Following a visual analysis, the funnel plot appears to be asymmetrical around the mean effect size. The Egger's test for funnel plot asymmetry confirmed the visual finding and indicated potential publication bias: t(6)=-6.08, p<0.01, which confirms asymmetry of the funnel plot. The fail-safe N revealed that 148,239 studies with a null finding would be required to change the statistical significance of the result.

Discussion

To the author's knowledge, this is the first meta-analysis that explores the linear association between alcohol use and depression severity as a continuous measure.

Twelve studies using eleven independent samples examining this association were identified. The methodological quality of the articles was mainly excellent or good, with only one exception, of fair methodological quality. Methodological quality ratings were ratified by an independent rater. When considering the strengths and weaknesses, all the articles were able to provide a clearly focussed issue to explore, and the authors took into account confounding variables in their analysis, however the reporting of results varied across studies. One of the main limitations across multiple articles was the lack of generalisability to a wider population. Other limitations included a lack of detail in the articles, for example some authors did not fully explain how they recruited participants or how research bias was minimised. Therefore, this must be taken into consideration when interpreting the results.

The results of the meta-analysis indicated a statistically significant, albeit small, positive correlation between alcohol use and depression severity. There was a large amount of heterogeneity within the sample (I^2=99.3%), therefore, moderator analyses were conducted investigating the potential influence of different depression measures, alcohol measures and risk of bias. This indicated that alcohol measures and risk of bias ratings moderated the association between depression severity and alcohol use. Publication bias was also evident, indicating that other studies in this area may have been produced but not published in scientific journals – which is referred to as the "file-drawer problem". However, the fail-safe N calculation for the primary meta-analysis was 171,227, indicating that a large amount of studies with a null hypothesis would be required to change the primary result.

Sensitivity analyses were conducted on the effects of gender, study design, alcohol measure, depression measure, adjusted statistics that include confounding variables, and methodological quality of articles. Most of the analyses supported the primary meta-analysis, however, there was no association between depression severity and alcohol use in the different groups within the gender construct. This is likely due to the small number of articles and reduced sample size when compared to the primary analysis, so no strong inferences can be made from this sensitivity analysis.

Association between the variables of interest

Overall, the meta-analysis aimed to identify studies that investigated the association between alcohol use and depression severity when using continuous measures of these constructs. The aim was to contribute to the evidence base surrounding the debate. This meta-analysis showed that as use of alcohol increases, the severity of depression increases; this relationship was moderated by alcohol use measure and article quality. However, this was a small effect size and the results should be interpreted with caution, due to the large amount of heterogeneity and publication bias.

The findings of the association between depression and alcohol have revealed a small positive correlation. This appears to support previous literature showing a positive association (El Ansari et al., 2013; Caldwell et al., 2001; King et al., 2003; Palfai et al., 2014; Park et al., 2015; Pavkovic et al., 2018; Sebena et al., 2012). A J-shaped association was found in Kim et al. (2015), and a U-shaped association for

non-Hispanic white males (Lipton, 2007). As such, one possibility is that the linear examination which is possible to examine using meta-analytic methods may be a suboptimal way to examine the relationship between these variables, which may follow a non-linear pattern. If this is true, as indicated by some studies in the field, the strength of (non-linear) associations could actually be larger than observed in this meta-analysis of linear correlations.

Limitations

When conducting the meta-analysis there were some limitations that should be considered when interpreting the results.

The search strategy did not include grey literature such as dissertations and unpublished findings, which could have contributed to the publication bias (McAuley, Pham, Tugwell, & Moher, 2000). As there was evidence of publication bias, this can restrict the interpretation of findings. Similarly, articles published in other languages were excluded from the analysis, due to the lack of reliable translation. However, this can introduce a language bias and gain fewer articles for the meta-analysis (CRD, 2009). Caution should be used when generalising the results to a wider population, as the results were subject to various sources of bias.

A large number of articles were screened for relevance, and four different databases were searched to find relevant articles. This is a strength of the analysis, as Akobeng (2005) only recommends using two databases. The databases were searched by the author, but it would have been useful for a second rater to screen the

articles for relevance to ensure all articles are identified, to increase the reliability. However, due to time and available resources this was not feasible (Crocetti, 2016).

Researchers often believe they are immune from human error; therefore, it is important to show transparency and honesty in the research process for other researchers to replicate the method. To ensure this research was carried out appropriately, the proposal was peer reviewed prior to implementation, publicly pre-registered in the PROSPERO database, and all articles were second-rated by an independent researcher (Veldcamp, 2017). The reporting standards for quantitative research (Appelbaum et al., 2018) were followed and a PRISMA checklist (Moher et al., 2009) was completed to ensure that all the pertinent pieces of information were included in the research (Appendix M).

The meta-analysis used a relatively small number of articles, and two articles used the same sample, therefore, to ensure that all samples were independent of each other, only one sample could be included in the analyses. Despite this, Valentine, Pigott, and Rothstein (2010) note that only two articles are required to carry out a meta-analysis. However, other authors suggest that at least 20 articles are required, to avoid reaching an incorrect conclusion (Rubio-Aparicio et al., 2017).

All articles were checked for methodological quality and risk of bias to ensure the findings were robust and appropriate to use within the meta-analysis. A limitation of the analysis was combining the two quality checklists into a quantitative outcome

for comparison, therefore the author carried out a qualitative synthesis as recommended (CASP, 2018).

A data extraction table was generated, which highlighted the different characteristics within the articles. When interpreting the results, it is important to consider the vast amount of heterogeneity between the studies, which can bias the results. A wide range of different countries were included, the data was collected in different settings, and utilised different measures of alcohol and depression, with cultural specificity incorporated.

When considering the method used within the analysis, the Hunter-Schmidt raw correlation coefficient was used to reduce the risk of a type 1 error, although research has found that when fewer than 15 effect sizes are pooled, the error rate was not controlled and the differences between the Hedges-Olkin were negligible (Hafdahl & Williams, 2009). In general, the Hunter-Schmidt method is considered to be the least biased estimate of the true effect of the two methods as it slightly underestimates the pooled effect (Stats Direct, 2020).

The results indicated a large amount of heterogeneity in the articles; therefore, caution should be taken when combining the articles as they may not be measuring the same association. There was a large amount of different measures to investigate alcohol use, and alcohol use measure was indicated as a moderator of the study, highlighting that this may affect the results. The measures of depression and alcohol

use are all self-reported, which can bias the results as people have a tendency to underestimate their alcohol use, especially to provide a more positive reflection of themselves (Davis, Thake, & Vilhena, 2010). However, all the articles used self-report measures, and therefore the risk of social desirability was consistent across the articles.

To interpret the meta-analysis results, a visual inspection of the funnel plot was carried out, which was subject to human bias. Simmonds (2015) found that the visual inspection of funnel plots is often misinterpreted, and both a visual inspection and a statistical test should be carried out. The author also carried out the Egger's test to reduce human error.

When interpreting subgroup analysis, it is recommended to only use a small number of analyses, as the likelihood of finding false positive and false negative tests increases with the more subgroup analyses conducted, therefore care was taken when considering the variables to include in the analyses (CRD, 2009).

Clinical implications

The clinical implication of this meta-analysis is that depression severity is correlated with alcohol use. A small effect size was found, which suggests that the bidirectional influence of one problem over another is fairly low, even if they commonly co-occur in time (i.e. this comorbidity is prevalent in clinical populations). Clinicians

often presume that people who drink more alcohol are harder to treat (Care Quality Commission, 2015), and research suggests that clients with a DD are more complex to treat (EMCDDA, 2016). Therefore, this documented association between alcohol use and symptoms of depression, should be considered by services when delivering interventions and developing service inclusion and exclusion criteria. When conducting an assessment, it is important to consider a client's depression severity and be aware that they may be drinking alcohol at levels above the national guidance, and that further assessment may be required to identify the impact, if any, of alcohol use on their lifestyle. If these co-occurring problems do not strongly influence each other, it is plausible that their co-occurrence may be caused by other common risk factors or vulnerabilities (Delgadillo, Böhnke, Hughes, & Gilbody, 2016). Clinicians should aim to better understand those underlying vulnerabilities and maintaining factors, rather than automatically assume that these problems "cause" clinically important changes in one another.

Due to the comorbidity of alcohol use and depression, it is important that services do not actively or unintentionally discriminate against people with a DD. Clinical services should be commissioned and delivered in such a way that they are sensitive and responsive to the needs of people with comorbid mental health and substance use difficulties, offering integrated treatment addressing all co-occurring needs and offering multi-disciplinary care where appropriate.

Future research

To further the evidence base, it would be useful to explore the effects of exact units of alcohol, however, the articles often used tools to measure the different patterns of alcohol use, and problematic drinking was not measured in a systematic way. Future research could measure alcohol use objectively to increase the robustness of the association, as all the articles used self-reported outcome measures.

A limited number of moderator analyses were conducted to avoid the risk of false positives (CRD, 2009), however, the heterogeneity may be accounted for in other variables that were not identified in this meta-analysis.

The focus on alcohol use and depression has been considered for decades, and we are aware of the link between the two difficulties. However, more research is required to explore the actual effect, the evidence for this association on a continuum and, the treatment outcomes, rather than clinicians solely basing their judgement on alcohol use to exclude a client from therapy. In particular, the question still remains as to whether or not the alcohol-depression association may follow a non-linear pattern. Conventional meta-analysis, as applied in this review, is not an optimal way to examine potential non-linear associations. Future studies could approach this question using independent-data (IPD) meta-analysis, which would enable the combination of raw data across studies and the fitting of non-linear trends.

Conclusion

The aim of the review was to identify studies that investigated the association between alcohol use and depression severity on a continuum. This was due to the varying results found in the current literature. This meta-analysis is unique, in that it explored the association of depression severity using a continuum, rather than a dichotomy. The results indicated that depression severity and alcohol use have a small positive correlation. The results should be interpreted with caution due to the large amount of heterogeneity and publication bias. Further research into alcohol use severity using a continuum of exact units of alcohol would be beneficial to reduce the heterogeneity across articles. Furthermore, it would be beneficial to consider the impact that this association has on clinical outcome and service delivery.

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Appendices

Appendix A – Prospero registration

NIHR | National Institute for Health Research

PROSPERO
International prospective register of systematic reviews

A review of associations between alcohol use and depression severity

Vanessa Hunt, Jaime Delgadillo

Citation

Vanessa Hunt, Jaime Delgadillo. A review of associations between alcohol use and depression severity. PROSPERO 2018 CRD42018096548 Available from: https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42018096548

Review question

Population: Adult, experiencing symptoms of depression, clinical and general population.

Intervention: NA

Comparison: Comparing the severity of depression in people with different patterns of alcohol use.

Outcome: Validated measures of depression severity

Searches

PsycINFO, MEDLINE, Scopus, and Web of Science databases will be searched. Search dates will include articles up to April 2020. All articles will be published in the English language.

Types of study to be included

Peer reviewed study designs such as observational studies and trials will be included.

Qualitative studies and single case reports will be excluded. Editorials, newspaper articles and other forms of popular media will be excluded. Non-empirical studies and studies that are not written in the English language will be excluded.

Condition or domain being studied

Symptoms of depression and alcohol use in adults.

Participants/population

Inclusion Criteria: All participants must be over 16 years old. Participant's symptoms of depression are measured using a validated measure using a continuous severity scoring criteria. Participants discuss alcohol intake.

The exclusion criteria includes: Studies involving children. Studies that do not use measures of alcohol use. Studies that do not include continuous measures of depression severity. Studies that use binary measures of assessing depression such as simple diagnostic yes/no classifications. Studies that do not measure alcohol use and symptoms of depression at the same time. Studies that do not use validated measures to assess symptoms of depression.

Intervention(s), exposure(s)

The association between alcohol use and depression severity.

Comparator(s)/control
Comparing the severity of depression in people with different patterns of alcohol use.

Context

Main outcome(s)
The main outcomes are to review the associations between alcohol use and depression severity.

* Measures of effect

There are no timing or effect measures.

Additional outcome(s)
There are no additional outcomes.

* Measures of effect

Not applicable.

Data extraction (selection and coding)
The reviewer will read the Cochrane Handbook and Cochrane Data Extraction and Assessment Template regarding the process to be followed for summarising the studies. Data will be extracted from relevant papers using a predefined summary template created in accordance with the above guidance. Data will be collected regarding the reasons for: participant exclusion criteria, characteristics of included studies, participants, and outcomes. The final decision for inclusion or exclusion will be made by the researcher conducting the review.

Risk of bias (quality) assessment
Risk of bias across studies will be assessed using the Downs and Black (Downs & Black, 1998) quality checklist and the Critical Appraisal Skills Programme (CASP) for cohort studies. A random sample of primary studies will be double rated by an independent assessor. If no agreement is made a third independent assessor will be utilised.

Strategy for data synthesis
A meta-analysis will be conducted.

Analysis of subgroups or subsets
The researcher will explore the level of alcohol use and depression severity.

Contact details for further information
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Organisational affiliation of the review
Leeds Community Healthcare NHS Trust and The University of Sheffield

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Review team members and their organisational affiliations
Mrs Vanessa Hunt. NHS & University of Sheffield
Dr Jaime Delgadillo. NHS & University of Sheffield

Type and method of review
Meta-analysis

Anticipated or actual start date
01 May 2018

Anticipated completion date
30 May 2020

Funding sources/sponsors
The University of Sheffield

Conflicts of interest
Both Vanessa and Jaime work for the NHS and University of Sheffield.
Yes

Language
English

Country
England

Stage of review
Review Completed not published

Subject index terms status
Subject indexing assigned by CRD

Subject index terms
Alcohol Drinking; Depression; Depressive Disorder; Humans

Date of registration in PROSPERO
23 May 2018

Date of publication of this version
18 February 2020

Details of any existing review of the same topic by the same authors

Stage of review at time of this submission

Stage	Started	Completed
Preliminary searches	Yes	Yes
Piloting of the study selection process	Yes	Yes
Formal screening of search results against eligibility criteria	Yes	Yes
Data extraction	Yes	Yes
Risk of bias (quality) assessment	Yes	Yes
Data analysis	Yes	Yes

Revision note
I have updated my dates as I was on maternity leave for a year which has affected my review.

Versions
23 May 2018
18 February 2020

Appendix B – PICO framework

Population	Intervention	Comparison	Outcome
Adult Symptoms of depression Clinical and general population	NA	Comparing the severity of depression in people with different patterns of alcohol use	Validated measures of depression severity

Appendix C – Screening tools for depression

ADAMS OR Anxiety Depression and Mood Scale OR BAI OR Beck Anxiety Inventory OR BDI OR Beck Depression Inventory OR BHS OR Beck Hopelessness Scale OR BSI OR Brief Symptom Inventory OR CES D OR Centre for Epidemiologic Studies Depression Scale OR CDS OR Cardiac Depression Scale OR Carroll Rating Scale for Depression OR CDSS OR Cornell Scale for Depression in Dementia OR DASS OR Depression Anxiety Stress Scales OR DASS 21 OR Depression Anxiety Stress Scales Short Form OR DIAMOND OR Diagnostic Interview for Anxiety Mood Obsessive Compulsive and Related Neuropsychiatric Disorders OR DUKE AD OR Duke Anxiety Depression Scale OR EPDS OR Edinburgh Postnatal Depression Scale OR GDS OR Geriatric Depression Scale OR GRID HAMD OR GRID Hamilton Depression Rating Scale OR HADS OR Hospital Anxiety Depression Scale OR HAM D OR Hamilton Depression Scale OR HAM D24 OR Hamilton Depression Scale 24 item OR HAM-D28 OR Hamilton Depression Scale 28 item OR IDS SR OR IDS C OR Inventory of Depressive Symptomology OR LIFE OR Longitudinal Interval Follow up Evaluation OR MADRS OR Montgomery Asberg Depression Rating Scale OR MASQ OR Mood and Anxiety Symptom Questionnaire OR MDI OR Major Depression Inventory OR ODQ OR Oxford Depression Questionnaire OR PANAS OR Positive and Negative Affect Schedule OR PHQ OR Patient Health Questionnaire OR POMS OR Profile of Mood States OR QIDS SR OR QIDS C OR Quick Inventory of Depressive Symptomatology OR SADS C OR Schedule for Affective Disorders and Schizophrenia Change Version OR SCL 90 R OR Symptom Checklist 90 Revised OR SDS OR Zung Self Rating Depression Scale OR SF36 OR SF 36 Health Survey OR Structured Interview Guide for the Hamilton Depression Rating Scale Seasonal Affective Disorders

Appendix D – Full search terms

PSYCINFO, WEB OF SCIENCE & MEDLINE

Depress* OR Low Mood OR Affective Disorder* AND Alcohol

AND ADAMS OR Anxiety Depression and Mood Scale OR BAI OR Beck Anxiety Inventory OR BDI OR Beck Depression Inventory OR BHS OR Beck Hopelessness Scale OR BSI OR Brief Symptom Inventory OR CES D OR Centre for Epidemiologic Studies Depression Scale OR CDS OR Cardiac Depression Scale OR Carroll Rating Scale for Depression OR CDSS OR Cornell Scale for Depression in Dementia OR DASS OR Depression Anxiety Stress Scales OR DASS 21 OR Depression Anxiety Stress Scales Short Form OR DIAMOND OR Diagnostic Interview for Anxiety Mood Obsessive Compulsive and Related Neuropsychiatric Disorders OR DUKE AD OR Duke Anxiety Depression Scale OR EPDS OR Edinburgh Postnatal Depression Scale OR GDS OR Geriatric Depression Scale OR GRID HAMD OR GRID Hamilton Depression Rating Scale OR HADS OR Hospital Anxiety Depression Scale OR HAM D OR Hamilton Depression Scale OR HAM D24 OR Hamilton Depression Scale 24 item OR HAM-D28 OR Hamilton Depression Scale 28 item OR IDS SR OR IDS C OR Inventory of Depressive Symptomology OR LIFE OR Longitudinal Interval Follow up Evaluation OR MADRS OR Montgomery Asberg Depression Rating Scale OR MASQ OR Mood and Anxiety Symptom Questionnaire OR MDI OR Major Depression Inventory OR ODQ OR Oxford Depression Questionnaire OR PANAS OR Positive and Negative Affect Schedule OR PHQ OR Patient Health Questionnaire OR POMS OR Profile of Mood States OR QIDS SR OR QIDS C OR Quick Inventory of Depressive Symptomatology OR SADS C OR Schedule for Affective Disorders and Schizophrenia Change Version OR SCL 90 R OR Symptom Checklist 90 Revised OR SDS OR Zung Self Rating Depression Scale OR SF36 OR SF 36 Health Survey OR Structured Interview Guide for the Hamilton Depression Rating Scale Seasonal Affective Disorders

SCOPUS

Depress* OR Low Mood OR Affective Disorder* AND Alcohol

AND ADAMS OR “Anxiety, Depression and Mood Scale” OR BAI OR “Beck Anxiety Inventory” OR BDI OR “Beck Depression Inventory” OR BHS OR “Beck Hopelessness Scale” OR BSI OR “Brief Symptom Inventory” OR CES-D OR “Centre for Epidemiologic Studies Depression Scale” OR CDS OR “Cardiac Depression Scale” OR “Carroll Rating Scale for Depression” OR CDSS OR “Cornell Scale for Depression in Dementia” OR DASS OR “Depression Anxiety Stress Scales” OR DASS-21 OR “Depression Anxiety Stress Scales Short Form” OR DIAMOND OR “Diagnostic Interview for Anxiety Mood Obsessive-Compulsive and Related Neuropsychiatric Disorders” OR DUKE-AD OR “Duke Anxiety – Depression Scale” OR EPDS OR “Edinburgh Postnatal Depression Scale” OR GDS OR “Geriatric Depression Scale” OR GRID-HAMD OR “GRID Hamilton Depression Rating Scale” OR HADS OR “Hospital Anxiety Depression Scale” OR HAM-D OR “Hamilton Depression Scale” OR HAM-D24 OR “Hamilton Depression Scale -24 item” OR HAM-D28 OR “Hamilton Depression Scale -28 item” OR IDS-SR OR IDS-C OR “Inventory of Depressive Symptomology” OR LIFE OR “Longitudinal Interval Follow-up Evaluation” OR MADRS OR “Montgomery-Asberg Depression Rating Scale” OR MASQ OR “Mood and Anxiety Symptom Questionnaire” OR MDI OR “Major Depression Inventory” OR ODQ OR “Oxford Depression Questionnaire” OR PANAS OR “Positive and Negative Affect Schedule” OR PHQ OR “Patient Health Questionnaire” OR POMS OR “Profile of Mood States” OR QIDS-SR OR QIDS-C OR “Quick Inventory of Depressive Symptomatology” OR SADS-C OR “Schedule for Affective Disorders and Schizophrenia -Change Version” OR SCL-90-R OR “Symptom Checklist 90 Revised” OR SDS OR “Zung Self-Rating Depression Scale” OR SF-36 OR “SF-36 Health Survey” OR “Structured Interview Guide for the Hamilton Depression Rating Scale – Seasonal Affective Disorders”

Appendix E – Email to authors

Fri, 15 Nov 2019, 19:31

Dear Sir/Madam,

I am currently carrying out a systematic review of the association between alcohol use and depression (https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=96548). I have selected your paper, [x] for the review. I would like to ask all authors of the selected papers for advice regarding any new papers or those in press that may be relevant to my review. Please respond by the 29th November 2019.

Best wishes,

Response from authors:

Response from author omitted

Author response omitted

Appendix F – Original data extraction table

Original data extraction table

Author (Date)	Design	Aim	Study setting	Participant characteristics	Measures of depression	Measures of alcohol	Main findings	Reported statistics	Covariates	Adjusted statistics
El Ansari, Sebena, & Stock (2013)	Obs	To examine the association between depressive symptoms and four indicators of alcohol consumption (high frequency of drinking, frequency of heavy episodic drinking, problem drinking and possible alcohol dependence)	Undergraduate students from seven universities England, Wales & Northern Ireland 2007-2008	n=3,220 Male: n=692, Female: n=2528 Mean age 22.2-31.6 years old	Modified BDI	Primary outcome: CAGE (problem drinking ≥2, possible alcohol dependence ≥3) Frequency of alcohol consumption (low frequency less than once a week, high frequency drinking a few times or more each week) Episodic drinking (non-episodic drinkers in the last two weeks have not had five or more alcoholic drinks in a single sitting, heavy episodic drinkers had 5 or more drinks in a single sitting in the last two weeks	Depressive symptoms were associated with problem drinking and possible alcohol dependence for both genders, after controlling for covariates	Adjusted data only	Gender, age, university, having an intimate relationship, & accommodation during the semester	High frequency of drinking Female: 1.02 (0.99-1.03) NS. Male: 0.99 (0.98-1.01), NS. Frequency of heavy episodic drinking: Female: 1.01 (0.99-1.03), NS Male: 0.99 (0.97-1.02), NS Problem drinking: Female: 1.03 (1.02-1.04), p<0.001 Male: 1.02 (1.01-1.04), p<0.001 Possible alcohol dependence: Female: 1.03 (1.02-1.04) p< 0.001 Male: 1.03 (1.02-1.05), p<0.001

Author (Date)	Design	Aim	Study setting	Participant characteristics	Measures of depression	Measures of alcohol	Main findings	Reported statistics	Covariates	Adjusted statistics
Caldwell, Rogers, Jorm, Christensen, Jacomb, Korten, & Lynskey (2001)	Obs	To examine the associations between measures of wellbeing and alcohol consumption	Community residents, path through life project Canberra, Australia March 1999-February 2000	n=2404 Male: n=1096, Female: n=1180 20-24 years old	Primary outcome: Goldberg depression scale PANAS	Weekly consumption (derived from quantity and frequency items within the AUDIT: Male: (weekly use) Light 1-13 units, moderate 14-27 units, hazardous 28-42 units, harmful >42 units. Female: (weekly use) Light 1-7 units, moderate 8-13units, hazardous 14-28 units, harmful >28 units	Depression is significantly related to overall alcohol consumption in males after adjusting for covariates. Compared to the light drinkers, both the non/occasional drinkers, and the hazardous/harmful drinkers had significantly higher depression scores in male participants. Females had higher levels of depression and negative affect was associated with hazardous/harmful alcohol consumption	Goldberg depression: Means Male: non/occasional 2.84 (0.13) p<0.001, light 2.32 (0.09), moderate 2.51 (0.20), hazardous/harmful 3.61 (0.27) p<0.001. Female: non occasional 3.16 (0.13), light 3.01 (0.10), moderate 3.31 (0.22), hazardous/harmful 3.80 (0.27) p<0.05 Negative affect: Means male: non occasional 18.08 (0.37), light 17.43 (0.26), moderate 17.38 (0.57), hazardous/harmful 18.76 (0.76). Female: non occasional 19.31 (0.36), light 13.13 (0.31), moderate 19.87 (0.67), hazardous/harmful 21.83 (0.82) p<0.05	Current tobacco use, current marijuana consumption, past hazardous/harmful drinking levels, physical health, financial hardship, stressful life events, adverse childhood events, support from family and friends, education, personality, & behavioural style	Depression Male: Adjusted for tobacco marijuana, life events: non occasional 2.96 (0.16) p<0.001, light 2.32 (0.12), moderate 2.32 (0.19), hazardous/harmful 3.06 (0.26) p<0.001. Adjusted for tobacco, marijuana: non/occasional 3.02 (0.16) p<0.001, light 2.32 (0.12), moderate 2.28 (0.20), hazardous/harmful 3.20 (0.27) p<0.001. Adjusted for extraversion, PCS-12, paid work: non occasional 2.60 (0.14), light 2.32 (0.11), moderate 2.55 (0.21), hazardous/harmful 3.60 (0.27) p<0.001. Female: Adjusted for marijuana, tobacco, education, looking for work, life events: non/occasional 3.19 (0.18), light 3.01 (0.18), moderate 2.96 (0.25), hazardous/harmful 3.16 (0.28). Adjusted for tobacco, marijuana: non/occasional 3.29 (0.16) light 3.01 (0.15), moderate 3.00 (0.23), hazardous/harmful 3.35 (0.27). Adjusted for life events: non/occasional 3.17 (0.11), light 3.01 (0.10), moderate 3.16 (0.21), hazardous/harmful 3.51 (0.25) Adjusted for education, looking for work: non/occasional 3.02 (0.16) light 3.01 (0.17)

											moderate 3.27 (0.25), hazardous/harmful 3.61 (0.28) Adjusted tables: Negative affect none for males. Female: Adjusted for marijuana, tobacco, education, looking for work, life events: non/occasional 19.44 (0.55), light 19.13 (0.55), moderate 19.12 (0.75), hazardous/harmful 20.16 (0.84). Adjusted for tobacco, marijuana: non/occasional 19.58 (0.50) light 19.13 (0.45), moderate 19.20 (0.69), hazardous/harmful 20.75 (0.83). Adjusted life events: non/occasional 19.35 (0.33), light 19.13 (0.29), moderate 19.41 (0.63), hazardous/harmful 20.92 (0.77) p<0.05. Adjusted for education, looking for work: non/occasional 19.05 (0.49), light 19.13 (0.51), moderate 19.90 (0.77), hazardous/harmful 21.39 (0.86) p<0.05

Author (Date)	Design	Aim	Study setting	Participant characteristics	Measures of depression	Measures of alcohol	Main findings	Reported statistics	Covariates	Adjusted statistics
Choi & DiNitto (2011)	Obs	Examine gender and the association between depression and alcohol use (amount & frequency)	Community residents, National Social Life, Health and Aging Project (NSHAP) USA 2005-2006	n=2924 Male: n=1410, Female n=1514 57-85 years old	CES-D 11 item	Primary outcome: Quantity (average) number of drinks consumed on a drinking day: binge drinking male: 4+ drinks, female: 3+ drinks Frequency (average number of drinking days per week)	Regression results showed that for males heavy/binge drinking was significantly positively associated with depression severity. There was no association between alcohol use and symptoms of depression in females.	Male: not h/b drinker CES-D mean 4.63 (4.62). H/b drinker CES-D mean 7.72 (7.75, p<0.001). Female: not h/b drinker mean CES-D 5.82 (5.25) h/b drinker CES-D 5.25 (5.15)	Sociodemographic characteristics, health status, social support, & health-related variables	Male quantity: 2.39 (0.49) P<0.001), Female quantity 0.40 (0.62), p>0.05
Golding, Burnham, & Wells (1990)	Obs	Investigate the association of alcohol use with depressive symptoms among randomly selected Mexican-American and non-Hispanic White community residents	Community residents and in-patient mental health services, Los Angeles Epidemiologic Catchment Area study Los Angeles, USA 1980-1985	n=2393 Male: n=1110, Female: n=1222 Aged ≥ 18 years old	CES-D 20 item	Primary outcome: Quantity (Average number of drinks per day) Frequency (monthly, weekly, daily)	Frequency: Non-Hispanic white men's depression scores are lowest among weekly drinkers, slightly higher among monthly drinkers, intermediate in abstainers and highest in daily drinkers. Mexican American white men & all women - no significant differences between depression score and drinking frequency Quantity: Mean depression scores increase in men who consume 2 drinks compared to those consuming 1 or 3 drinks. Non-Hispanic white males: increase in depressive symptoms for participants who consume 4 or more drinks (x2 (4) = 13.41, p<0.001)	Male: Non-Hispanic white x2(4)=13.41,p<0.001 Mexican American (x2(4)=18.79,p<0.001) Female: Non-Hispanic white x2(4)=9.09,p<0.05 Mexican American x2(4)=6.29,p=>0.05	Gender, age, income, household size, education, marital status & employment	Male: Alcohol quantity was associated with depressive symptoms (Controlling for ethnicity, age, income, household size and education). Non-significant when controlled for marital and employment status. Beta=0.46, p>0.05 Women: Alcohol quantity is associated with depressive symptoms when not controlling for variables. Beta=0.44, p>0.05

Mexican American males: depression levels are low in men who drink 4 drinks but increase in those who consume 5+ ($x^2(4) = 18.79$, $p<0.001$)

Females:

Non-Hispanic white females: depression scores increase with quantity of alcohol consumed except at 5+ drinks slight decrease ($x^2(4)=9.09$, $p<0.05$).

Mexican American females: increased depression found in those drinking 3+ drinks, ($x^2(4)=6.29$ ns)

Author (Date)	Design	Aim	Study setting	Participant characteristics	Measures of depression	Measures of alcohol	Main findings	Reported statistics	Covariates	Adjusted statistics
Kim, Kim, Morris, & Park (2015)	Obs	Examine the nature and shape of any association between alcohol consumption and depression in an elderly South Korean population	Community residents Gangneung, South Korea 2002-2007	n=1819 Male: n=638, Female: n=1175 60-105 years old	Korean BDI 21 item	AUDIT 10 items (Korean cut off for problem drinking, score 12)	AUDIT total score was significantly associated with higher depression scores in both a linear and quadratic pattern. Once the data was adjusted for covariates a J shaped curve was observed. Abstainers and problem drinks were at higher risk of depression. Among non-problem drinkers the effect of alcohol use was negatively related to depression, however for problem drinkers as increased alcohol use was associated with higher levels of depression after controlling for covariates	One-way ANOVA F=18.59 <0.001 (AUDIT & BDI)	Age, smoking status, exercise, marital status, physical health & mental health	Beta -0.32, p<0.001
King, Bernardy, & Hauner (2003)	Obs	Examine relationships among stressful events, personality characteristics and affective states of various drinking patterns	Alcohol treatment centres and community residents USA Date unavailable	n=154 Male: n=83, Female: n=71 18-51 years old	BDI 21 item	Quantity-frequency Index (3 groups - alcohol dependent (ALC), problematic/heavy drinkers (PD), Light social drinkers (LD)	Participants who are alcohol dependent reported significantly more symptoms of depression, when compared to problematic drinkers and light social drinkers. Females reported significantly more depressive symptoms when compared to males in the alcohol dependent and problematic drinking categories	Depression & BDI - (F(2,145)=17.97, p<0.0001)	Gender	Depression and BDI: F(1,145)=17.46, p<0.0001

Author (Date)	Design	Aim	Study setting	Participant characteristics	Measures of depression	Measures of alcohol	Main findings	Reported statistics	Covariates	Adjusted statistics
Lipton (1997)	Obs	Examine the role of moderate alcohol use in relation to stress and depression, to compare non-Hispanic whites, Mexican Americans born in the USA and Mexican Americans born in Mexico	Community residents and in-patient mental health services Los Angeles, USA 1980	n=1,444 Male: n=1,144, Female: n=0 Aged 18 ≥ years old	CES-D 20 item	Quantity and frequency classification (light-light moderate, moderate & heavy)	Non-Hispanic white males have a U-shaped association with alcohol use and depression severity, as moderate drinkers have lower levels of depression than heavy drinkers and abstainers. There was no association between depression severity and alcohol use in Mexican American males born in America. Mexicans American males born in Mexico had a J-shaped curve with abstainers-moderate drinkers having a less symptoms of depression when compared to heavy drinkers	In general, mean CES-D scores were lower for moderate alcohol users than other drinking categories across all 3 cultures. Fewer symptoms of depression were found in the light to moderate alcohol categories compared to abstainers and heavy drinkers for Mexican American immigrants and non-Hispanic white	Age, gender, socioeconomic status, education, & self-reported physical health status	US-born Mexican Americans: 95% CI, Abstainer 7.94(6.49-9.39), light/moderate-light 6.40 (5.03-7.77), moderate 5.28 (3.89-6.67), heavy 8.75 (6.71-10.79). Mexican Americans Mexican born Abstainer 8.21 (7.11-9.31), light/light-moderate 6.12 (4.61-7.63), moderate 4.70 (2.70-6.69), heavy 5.46 (3.66-7.26). US born non-Hispanic whites: Abstainer 6.11 (4.95-7.26), light/light moderate 5.60 (4.85-6.34), moderate 4.71 (4.02-5.40), heavy 6.43 (5.17-7.68)
Palfai, Cheng, Coleman, Bridden, Krupitsky, & Samet (2014)	RCT	Prospectively examine the influence of depressive symptoms on subsequent alcohol use behaviour among HIV-infected heavy drinking patients	4 inpatient and outpatient HIV and narcology (i.e. addiction treatment) care sites, HERMITAGE Trial (HIV's Evolution in Russia-Mitigating Infection Transmission and Alcoholism in a Growing Epidemic) St. Petersburg, Russia October 2007-April 2010	n=700 Male: n=415, Female: n=285 18-70 years old	Russian BDI 21 item	30 day time-line follow back - total number of heavy drinking days and number of drinks per day	When controlling for covariates, depressive symptoms was significantly associated with alcohol use	Significant effect of depression severity on drinks per day (global, p=0.03)	Age, gender, alcohol use, & injection drug use in last 6 months	Only available data: p=0.03

Author (Date)	Design	Aim	Study setting	Participant characteristics	Measures of depression	Measures of alcohol	Main findings	Reported statistics	Covariates	Adjusted statistics
Park, Lee, Oh, Jun, Lee, Kim, Kim, Yim, & Park (2015)	Obs	Identify clinical correlates of hazardous drinking	16 university affiliated hospitals and 2 general hospitals, Clinical Research Centre for Depression study (CRESCEND) for people on psychopharmacological treatment for depression Korea January 2006-August 2008	n=402 Male: n=151, Female: n=251 Mean age 42.6 years old	HAMD (8-16 mild depression, 17-23 moderate depression & ≥24 severe depression)	Korean AUDIT (Korean cut off for Hazardous drinking: male score 10, female score 6)	Participants who are classed as hazardous drinkers experience more depressive symptoms than non-hazardous drinkers	No difference between hazardous/non-hazardous drinking & symptom severity (x2 = 0.110, p=0.574)	Age & gender	Not reported.
Pavkovic, Zaric, Markovic, Klacar, Huljic, & Caricic (2018)	Obs	Examine the relationship between alcoholism and depression	Health Centre Čukarica, Belgrade, Serbia March-September 2017	n=421 Male: n=175, Female: n=246 19-65 years old	BDI- 21 items (1-10 normal, 11-16 mild, 17-20 borderline clinical depression, 21-30 moderate depression, 31-40 severe depression & 40+ very severe depression)	MAST (0-2 no apparent problem, 3-5 early or middle problem drinking & 6+ problem drinking)	Alcohol use showed a positive association with depressive symptoms, after controlling for confounders	More problematic level of alcohol use is associated with depression symptom severity, MAST score & depression r(420)= 0.75, p<0.05	Gender	Males: r=0.74, p<0.05 Females: r=0.79, p<0.05

Author (Date)	Design	Aim	Study setting	Participant characteristics	Measures of depression	Measures of alcohol	Main findings	Reported statistics	Covariates	Adjusted statistics
Sebena, El Ansari, Stock, Orosova, & Mikolajczyk (2012)	Obs	Investigate the association between perceived stress, symptoms of depression and religiosity with alcohol consumption and problem drinking	University freshmen sample Germany, Poland, Bulgaria, UK & Slovakia Germany, Poland & Bulgaria -May 2005, UK -May 2007 & Slovakia -May 2008	n=2,503 (Germany: n=654, Poland: n= 561, Bulgaria: n=688, UK: n=311 & Slovakia: n=315) Male: n=866, Female: n=1,637 Mean age 20.37 years old	Modified BDI	Primary outcome: CAGE- problem drinking Frequency of alcohol use (low- drinking once a week or less, high drinking several times per week)	Depression symptoms were associated with problem drinking after adjusting for gender, country, perceived sufficiency of income and importance of religious faith	Depression severity was not associated with high frequency of drinking but were associated with problem drinking after adjusting for gender, country, perceived income sufficiency, importance of religious faith	Gender, country, perceived sufficiency of income, & importance of religious faith	Problem drinking & depression: OR 1.26 (1.17-1.37), df 1, p<0.001 Wald chi-square test 34.34 High frequency of drinking & depression: OR 1.03 (0.95-1.11) p0.655, df 1, WALD 0.48
Sullivan, Saitz, Cheng, Libman, Nunes, & Samet (2008)	Obs	To examine the impact of alcohol use on depression symptoms with people with HIV	Specialist HIV clinics and health care centres, HIV-Longitudinal Interrelationships of Viruses and Ethanol study (HIV-LIVE) USA August 2001 - July 2003	n=400 Male: n=300, Female: n=100 21-71 years old	CES-D 20 item	Primary outcome: Alcohol consumption: Past month alcohol consumption (heavy drinking more than 4 drinks a day or more than 14 drinks per week on average for men & more than 3 or more than 7 drinks respectively for females) Alcohol dependence: Not heavy drinking - none or moderate AND abstinent, moderate (any alcohol consumption not heavy), heavy drinking and very heaving drinking (>4 separate days of more than four drinks on 1 day for men and >4 separate days of more than three drinks on one day for females	Alcohol use is associated with more depressive symptoms in HIV-infected patients before controlling for confounders. After the adjustment for confounders, this is no longer significant	Past month alcohol consumption (4 levels) appeared to increase with depression severity but this was not statistically significant Mean CES-D Scores are significantly higher for heavy drinkers compared to not heavy drinkers Means: 1.76(0.53-2.98) 95% CI p=0.005	Age, gender, race, homelessness, hepatis C virus antibody status, Katz comorbidity scale, past month illicit drug use, antiretroviral therapy medication use and adherence, CD4 cell counts, HIV log RNA, & time in months since study enrolment	means: 1.04(-0.24-2.32) 95% CI, p=0.11

Notes:

Design: OBS – Observational Study; RCT- Randomised Controlled Trial.

Measures of alcohol: AUDIT - Alcohol Use Disorder Identification Test; MAST - Michigan Alcoholism screening test, CAGE: Cut down, Annoyed by criticism, Guilty, and Eye opener.

Measures of depression: CES-D - Centre for Epidemiological Studies -depression; BDI - Beck Depression Inventory; HAMD - Hamilton Depression Rating Scale; GDS - Goldberg Depression scale.

Countries: USA – United States of America; UK – United Kingdom

Other: NS – Non-significant, H/B: Heavy binge drinking; HIV – Human Immunodeficiency Virus

Appendix G – Downs and Black checklist

Appendix

Checklist for measuring study quality

Reporting

1. *Is the hypothesis/aim/objective of the study clearly described?*

yes	1
no	0

2. *Are the main outcomes to be measured clearly described in the Introduction or Methods section?*
If the main outcomes are first mentioned in the Results section, the question should be answered no.

yes	1
no	0

3. *Are the characteristics of the patients included in the study clearly described?*
In cohort studies and trials, inclusion and/or exclusion criteria should be given. In case-control studies, a case-definition and the source for controls should be given.

yes	1
no	0

4. *Are the interventions of interest clearly described?*
Treatments and placebo (where relevant) that are to be compared should be clearly described.

yes	1
no	0

5. *Are the distributions of principal confounders in each group of subjects to be compared clearly described?*
A list of principal confounders is provided.

yes	2
partially	1
no	0

6. *Are the main findings of the study clearly described?*
Simple outcome data (including denominators and numerators) should be reported for all major findings so that the reader can check the major analyses and conclusions. (This question does not cover statistical tests which are considered below).

yes	1
no	0

7. *Does the study provide estimates of the random variability in the data for the main outcomes?*
In non normally distributed data the inter-quartile range of results should be reported. In normally distributed data the standard error, standard deviation or confidence intervals should be reported. If the distribution of the data is not described, it must be assumed that the estimates used were appropriate and the question should be answered yes.

yes	1
no	0

8. *Have all important adverse events that may be a consequence of the intervention been reported?*
This should be answered yes if the study demonstrates that there was a comprehensive attempt to measure adverse events. (A list of possible adverse events is provided).

yes	1
no	0

9. *Have the characteristics of patients lost to follow-up been described?*
This should be answered yes where there were no losses to follow-up or where losses to follow-up were so small that findings would be unaffected by their inclusion. This should be answered no where a study does not report the number of patients lost to follow-up.

yes	1
no	0

10. *Have actual probability values been reported (e.g. 0.035 rather than <0.05) for the main outcomes except where the probability value is less than 0.001?*

yes	1
no	0

External validity

All the following criteria attempt to address the representativeness of the findings of the study and whether they may be generalised to the population from which the study subjects were derived.

11. *Were the subjects asked to participate in the study representative of the entire population from which they were recruited?*
The study must identify the source population for patients and describe how the patients were selected. Patients would be representative if they comprised the entire source population, an unselected sample of consecutive patients, or a random sample. Random sampling is only feasible where a list of all members of the relevant

population exists. Where a study does not report the proportion of the source population from which the patients are derived, the question should be answered as unable to determine.

yes	1
no	0
unable to determine	0

12. *Were those subjects who were prepared to participate representative of the entire population from which they were recruited?*
The proportion of those asked who agreed should be stated. Validation that the sample was representative would include demonstrating that the distribution of the main confounding factors was the same in the study sample and the source population.

yes	1
no	0
unable to determine	0

13. *Were the staff, places, and facilities where the patients were treated, representative of the treatment the majority of patients receive?*
For the question to be answered yes the study should demonstrate that the intervention was representative of that in use in the source population. The question should be answered no if, for example, the intervention was undertaken in a specialist centre unrepresentative of the hospitals most of the source population would attend.

yes	1
no	0
unable to determine	0

Internal validity – bias

14. *Was an attempt made to blind study subjects to the intervention they have received ?*
For studies where the patients would have no way of knowing which intervention they received, this should be answered yes.

yes	1
no	0
unable to determine	0

15. *Was an attempt made to blind those measuring the main outcomes of the intervention?*

yes	1
no	0
unable to determine	0

16. *If any of the results of the study were based on "data dredging", was this made clear?*
Any analyses that had not been planned at the outset of the study should be clearly indicated. If no retrospective unplanned subgroup analyses were reported, then answer yes.

yes	1
no	0
unable to determine	0

17. *In trials and cohort studies, do the analyses adjust for different lengths of follow-up of patients, or in case-control studies, is the time period between the intervention and outcome the same for cases and controls ?*
Where follow-up was the same for all study patients the answer should yes. If different lengths of follow-up were adjusted for by, for example, survival analysis the answer should be yes. Studies where differences in follow-up are ignored should be answered no.

yes	1
no	0
unable to determine	0

18. *Were the statistical tests used to assess the main outcomes appropriate?*
The statistical techniques used must be appropriate to the data. For example non-parametric methods should be used for small sample sizes. Where little statistical analysis has been undertaken but where there is no evidence of bias, the question should be answered yes. If the distribution of the data (normal or not) is not described it must be assumed that the estimates used were appropriate and the question should be answered yes.

yes	1
no	0
unable to determine	0

19. *Was compliance with the intervention/s reliable?*
Where there was non compliance with the allocated treatment or where there was contamination of one group, the question should be answered no. For studies where the effect of any misclassification was likely to bias any association to the null, the question should be answered yes.

yes	1
no	0
unable to determine	0

20. *Were the main outcome measures used accurate (valid and reliable)?*

For studies where the outcome measures are clearly described, the question should be answered yes. For studies which refer to other work or that demonstrates the outcome measures are accurate, the question should be answered as yes.

yes	1
no	0
unable to determine	0

Internal validity – confounding (selection bias)

21. *Were the patients in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited from the same population?*
For example, patients for all comparison groups should be selected from the same hospital. The question should be answered unable to determine for cohort and case-control studies where there is no information concerning the source of patients included in the study.

yes	1
no	0
unable to determine	0

22. *Were study subjects in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited over the same period of time?*
For a study which does not specify the time period over which patients were recruited, the question should be answered as unable to determine.

yes	1
no	0
unable to determine	0

23. *Were study subjects randomised to intervention groups?*
Studies which state that subjects were randomised should be answered yes except where method of randomisation would not ensure random allocation. For example alternate allocation would score no because it is predictable.

yes	1
no	0
unable to determine	0

24. *Was the randomised intervention assignment concealed from both patients and health care staff until recruitment was complete and irrevocable?*
All non-randomised studies should be answered no. If assignment was concealed from patients but not from staff, it should be answered no.

yes	1
no	0
unable to determine	0

25. *Was there adequate adjustment for confounding in the analyses from which the main findings were drawn?*
This question should be answered no for trials if: the main conclusions of the study were based on analyses of treatment rather than intention to treat; the distribution of known confounders in the different treatment groups was not described; or the distribution of known confounders differed between the treatment groups but was not taken into account in the analyses. In non-randomised studies if the effect of the main confounders was not investigated or confounding was demonstrated but no adjustment was made in the final analyses the question should be answered as no.

yes	1
no	0
unable to determine	0

26. *Were losses of patients to follow-up taken into account?*
If the numbers of patients lost to follow-up are not reported, the question should be answered as unable to determine. If the proportion lost to follow-up was too small to affect the main findings, the question should be answered yes.

yes	1
no	0
unable to determine	0

Power

27. *Did the study have sufficient power to detect a clinically important effect where the probability value for a difference being due to chance is less than 5%?*
Sample sizes have been calculated to detect a difference of x% and y%.

	Size of smallest intervention group	
A	$<n_x$	0
B	n_x-n_y	1
C	n_x-n_y	2
D	n_x-n_y	3
E	n_x-n_y	4
F	n_y+	5

Appendix H – Critical Appraisal Skills Checklist

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CASP Checklist: 12 questions to help you make sense of a **Cohort Study**

How to use this appraisal tool: Three broad issues need to be considered when appraising a cohort study:

- Are the results of the study valid? (Section A)
- What are the results? (Section B)
- Will the results help locally? (Section C)

The 12 questions on the following pages are designed to help you think about these issues systematically. The first two questions are screening questions and can be answered quickly. If the answer to both is "yes", it is worth proceeding with the remaining questions. There is some degree of overlap between the questions, you are asked to record a "yes", "no" or "can't tell" to most of the questions. A number of italicised prompts are given after each question. These are designed to remind you why the question is important. Record your reasons for your answers in the spaces provided.

About: These checklists were designed to be used as educational pedagogic tools, as part of a workshop setting, therefore we do not suggest a scoring system. The core CASP checklists (randomised controlled trial & systematic review) were based on JAMA 'Users' guides to the medical literature 1994 (adapted from Guyatt GH, Sackett DL, and Cook DJ), and piloted with health care practitioners.

For each new checklist, a group of experts were assembled to develop and pilot the checklist and the workshop format with which it would be used. Over the years overall adjustments have been made to the format, but a recent survey of checklist users reiterated that the basic format continues to be useful and appropriate.

Referencing: we recommend using the Harvard style citation, i.e.: *Critical Appraisal Skills Programme (2018). CASP (insert name of checklist i.e. Cohort Study) Checklist. [online] Available at: URL. Accessed: Date Accessed.*

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Critical Appraisal Skills Programme

Paper for appraisal and reference: .....

Section A: Are the results of the study valid?

1. Did the study address a clearly focused issue?

Yes ☐
Can't Tell ☐
No ☐

HINT: A question can be 'focused' in terms of
- the population studied
- the risk factors studied
- is it clear whether the study tried to detect a beneficial or harmful effect
- the outcomes considered

Comments:

2. Was the cohort recruited in an acceptable way?

Yes ☐
Can't Tell ☐
No ☐

HINT: Look for selection bias which might compromise the generalisability of the findings
- was the cohort representative of a defined population
- was there something special about the cohort
- was everybody included who should have been

Comments:

Is it worth continuing?

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3. Was the exposure accurately measured to minimise bias?

Yes ☐
Can't Tell ☐
No ☐

HINT: Look for measurement or classification bias

- did they use subjective or objective measurements
- do the measurements truly reflect what you want them to (have they been validated)
- were all the subjects classified into exposure groups using the same procedure

Comments:

4. Was the outcome accurately measured to minimise bias?

Yes ☐
Can't Tell ☐
No ☐

HINT: Look for measurement or classification bias

- did they use subjective or objective measurements
- do the measurements truly reflect what you want them to (have they been validated)
- has a reliable system been established for detecting all the cases (for measuring disease occurrence)
- were the measurement methods similar in the different groups
- were the subjects and/or the outcome assessor blinded to exposure (does this matter)

Comments:

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5. (a) Have the authors identified all important confounding factors?

Yes ☐
Can't Tell ☐
No ☐

HINT:
- list the ones you think might be important, and ones the author missed

Comments:

5. (b) Have they taken account of the confounding factors in the design and/or analysis?

Yes ☐
Can't Tell ☐
No ☐

HINT:
- look for restriction in design, and techniques e.g. modelling, stratified-, regression-, or sensitivity analysis to correct, control or adjust for confounding factors

Comments:

6. (a) Was the follow up of subjects complete enough?

Yes ☐
Can't Tell ☐
No ☐

HINT: Consider
- the good or bad effects should have had long enough to reveal themselves
- the persons that are lost to follow-up may have different outcomes than those available for assessment
- in an open or dynamic cohort, was there anything special about the outcome of the people leaving, or the exposure of the people entering the cohort

6. (b) Was the follow up of subjects long enough?

Yes ☐
Can't Tell ☐
No ☐

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Comments:

Section B: What are the results?

7. What are the results of this study?

HINT: Consider
- what are the bottom line results
- have they reported the rate or the proportion between the exposed/unexposed, the ratio/rate difference
- how strong is the association between exposure and outcome (RR)
- what is the absolute risk reduction (ARR)

Comments:

8. How precise are the results?

HINT:
- look for the range of the confidence intervals, if given

Comments:

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9. Do you believe the results?

Yes ☐
Can't Tell ☐
No ☐

HINT: Consider
- big effect is hard to ignore
- can it be due to bias, chance or confounding
- are the design and methods of this study sufficiently flawed to make the results unreliable
- Bradford Hills criteria (e.g. time sequence, dose-response gradient, biological plausibility, consistency)

Comments:

Section C: Will the results help locally?

10. Can the results be applied to the local population?

Yes ☐
Can't Tell ☐
No ☐

HINT: Consider whether
- a cohort study was the appropriate method to answer this question
- the subjects covered in this study could be sufficiently different from your population to cause concern
- your local setting is likely to differ much from that of the study
- you can quantify the local benefits and harms

Comments:

11. Do the results of this study fit with other available evidence?

Yes ☐
Can't Tell ☐
No ☐

Comments:

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11. What are the implications of this study for practice?

Yes	
Can't Tell	
No	

HINT: Consider

- one observational study rarely provides sufficiently robust evidence to recommend changes to clinical practice or within health policy decision making
- for certain questions, observational studies provide the only evidence
- recommendations from observational studies are always stronger when supported by other evidence

Comments:

Appendix I – Quality ratings

CASP

Author	Q1	Q2	Q3	Q4	Q5a	Q5b	Q6a	Q6b	Q7	Q8	Q9	Q10	Q11	Q12	Total / 28	Quality
El Ansari	2	2	2	2	2	2	2	2	2	2	2	2	2	2	28	Excellent
Caldwell	2	2	2	2	2	2	1	2	2	1	2	1	2	2	25	Good
Choi	2	1	2	2	2	2	1	2	2	2	2	0	2	2	24	Good
Golding	2	2	2	2	2	2	2	2	2	1	2	2	2	2	27	Excellent
Kim	2	2	2	2	2	2	1	2	2	2	2	1	1	2	25	Good
King	2	2	2	1	0	2	1	2	2	2	2	1	2	2	23	Good
Lipton	2	2	2	2	2	2	1	2	2	2	2	1	2	2	26	Excellent
Park	2	1	2	2	0	2	1	2	2	2	2	0	2	2	22	Good
Pavkovik	2	0	2	1	0	2	1	2	2	0	2	0	2	2	18	Fair
Sebena	2	2	2	2	2	2	1	2	2	2	2	0	2	2	25	Good
Sullivan	2	2	2	2	2	2	1	2	2	2	2	0	2	0	23	Good

Downs and Black

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	Total	Quality
Palfai	1	1	1	1	2	1	1	0	1	1	0	0	1	0	0	1	1	1	1	1	1	1	1	0	1	1	0	21/28	Good

Appendix J – Independent quality ratings

CASP

Study	Q1	Q2	Q3	Q4	Q5a	Q5b	Q6a	Q6b	Q7	Q8	Q9	Q10	Q11	Q12	Total /28	Quality
El Ansari	2	2	2	1	2	2	2	2	2	2	1	2	2	2	26	Excellent
Caldwell	2	2	2	2	2	2	0	2	2	2	2	1	2	2	25	Excellent
Choi	2	1	1	1	2	2	2	2	2	2	2	0	2	2	23	Good
Golding	2	2	1	2	2	2	2	2	2	1	2	2	2	2	26	Excellent
Kim	2	2	2	2	2	2	1	2	2	1	2	1	2	2	25	Excellent
King	2	2	2	1	0	2	1	2	2	2	2	1	2	2	23	Good
Lipton	2	2	2	2	2	2	1	2	2	2	2	1	2	2	26	Excellent
Park	2	1	2	1	0	2	1	2	2	2	2	0	2	2	21	Good
Pavkovik	2	0	2	1	0	2	0	2	2	0	1	0	2	2	16	Fair
Sebena	2	2	2	2	2	2	1	2	2	2	2	0	2	2	25	Excellent
Sullivan	2	2	2	2	2	2	1	2	2	2	2	0	2	0	23	Good

Downs and Black

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	Total	Quality
Palfai	1	1	1	1	2	1	1	0	1	1	0	0	1	0	0	1	1	1	1	1	1	1	1	0	1	1	0	21/28	Good

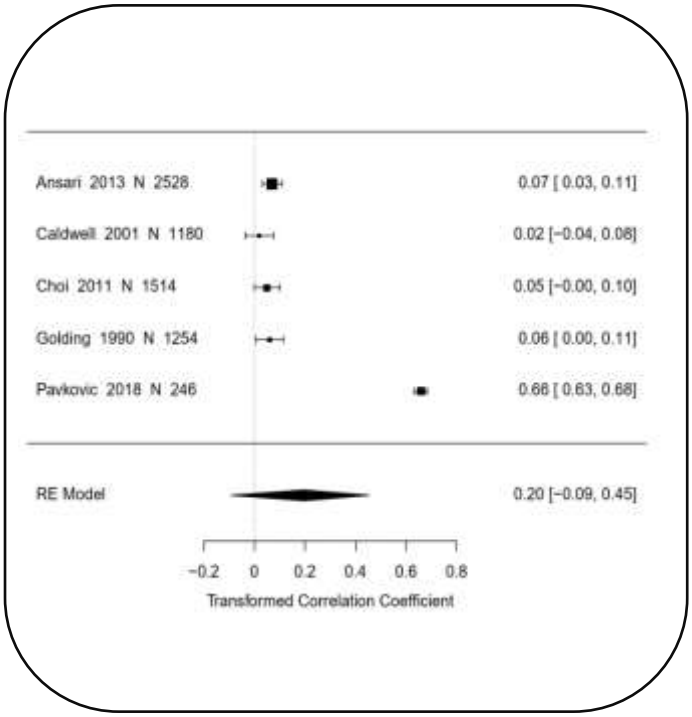
Appendix K – Inter-rater reliability

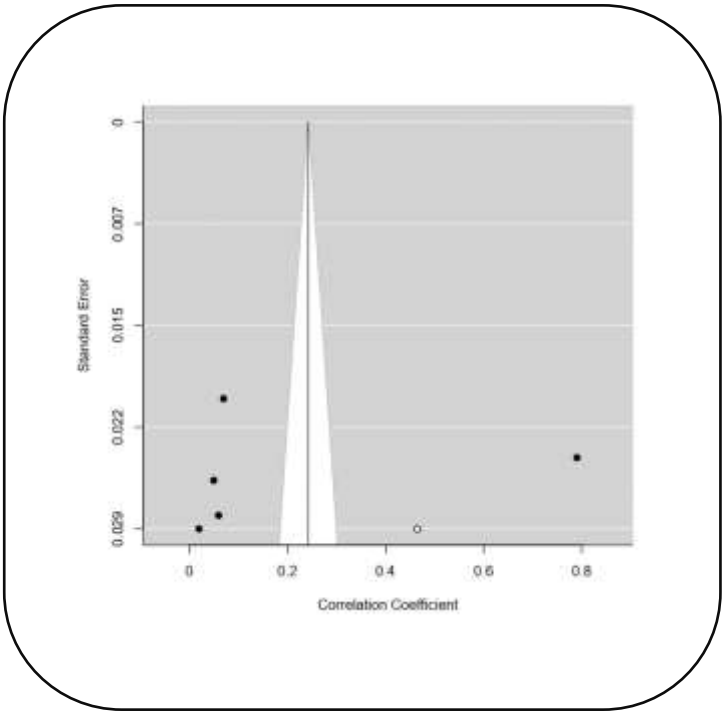
Checklist	Study	Peer rating/28	Quality	Author rating/28	Quality	Agree*
CASP	El Ansari	26	E	28	E	Yes
	Caldwell	25	G	25	G	Yes
	Choi	23	G	24	G	No
	Golding	26	E	27	E	Yes
	Kim	25	G	25	G	No
	King	23	G	23	G	Yes
	Lipton	26	E	26	E	Yes
	Park	21	G	22	G	Yes
	Pavkovik	16	F	18	F	Yes
	Sebena	25	G	25	G	Yes
	Sullivan	23	G	23	G	Yes
D&B	Palfai	21	G	21	G	Yes

Notes: E: Excellent; G: Good; F: Fair; CASP: Cohort checklist; D&B: Downs and Black checklist

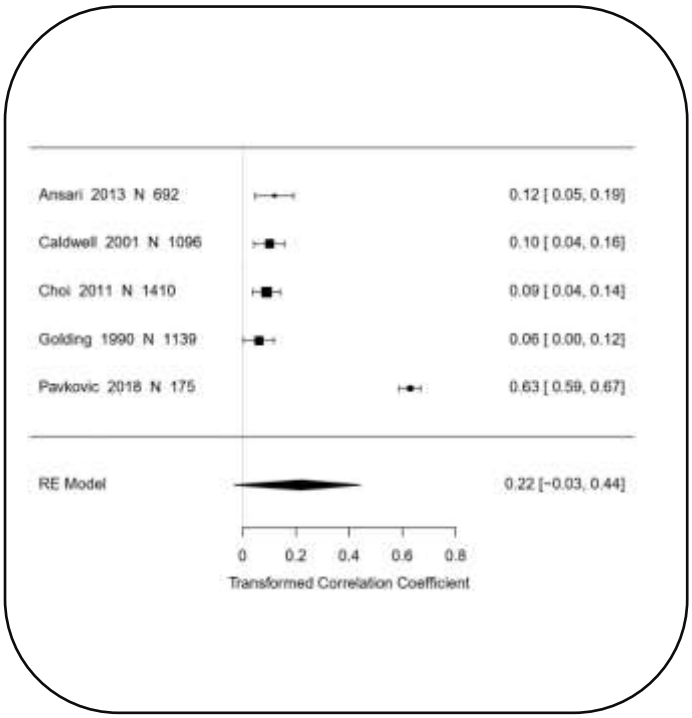
Appendix L – Forest plots and funnel plots for moderators

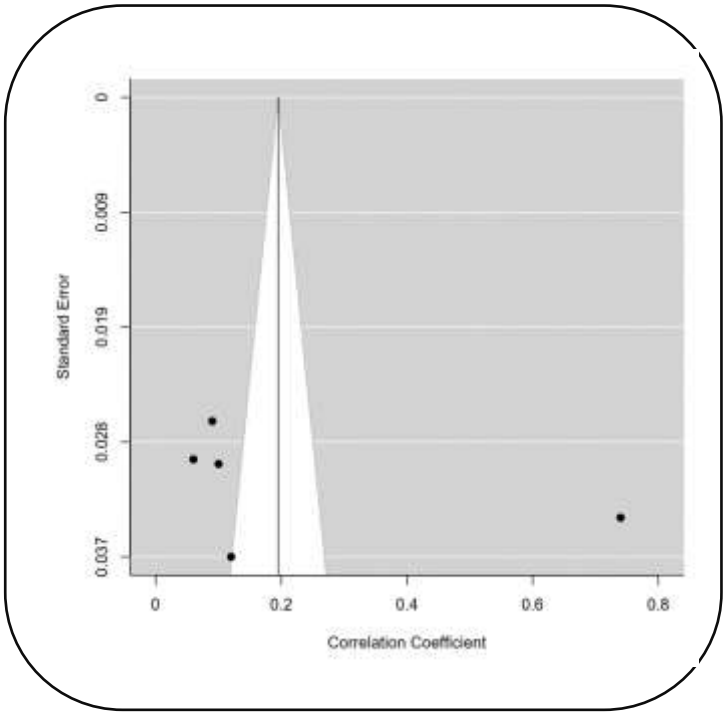
Female



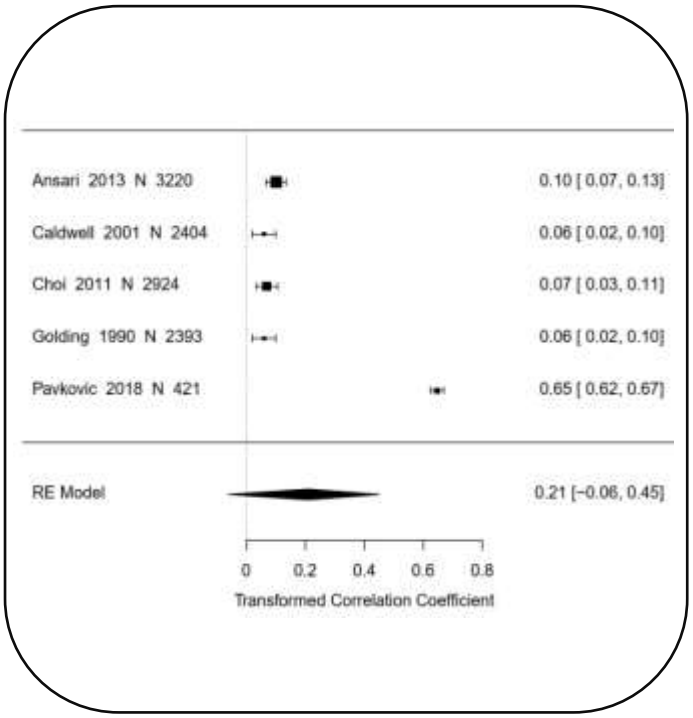


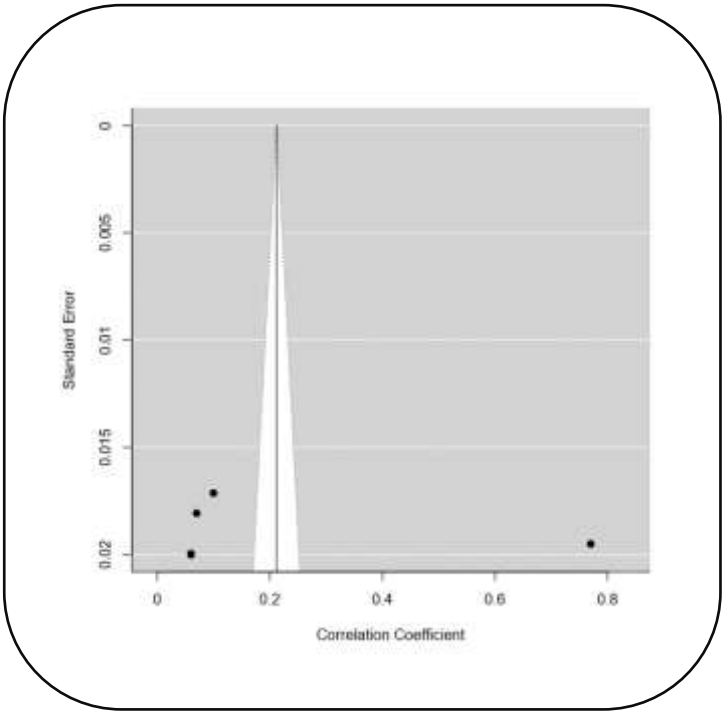
Male



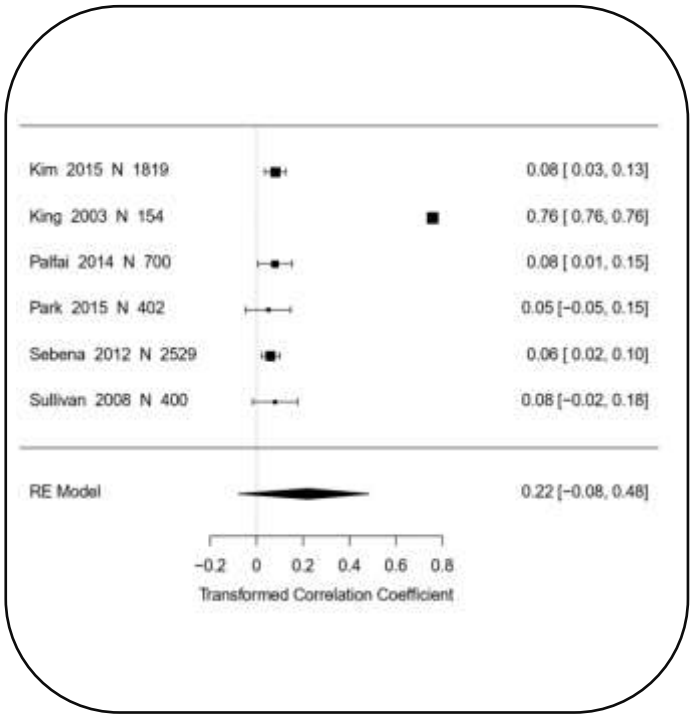


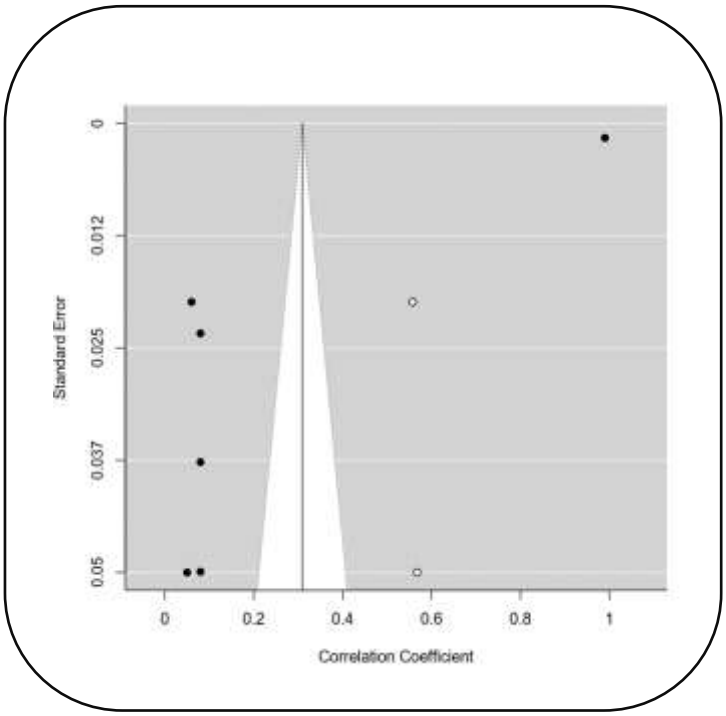
Split gender



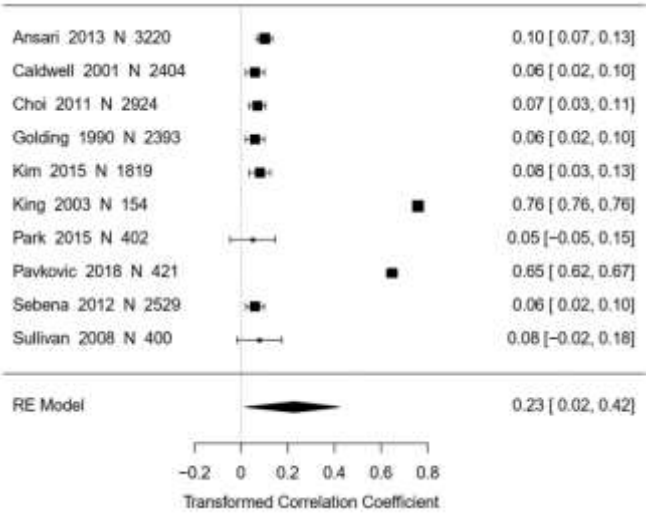


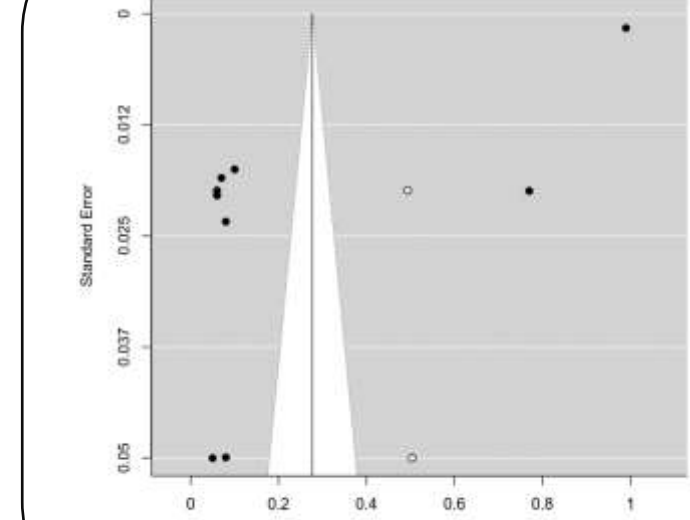
Pooled gender



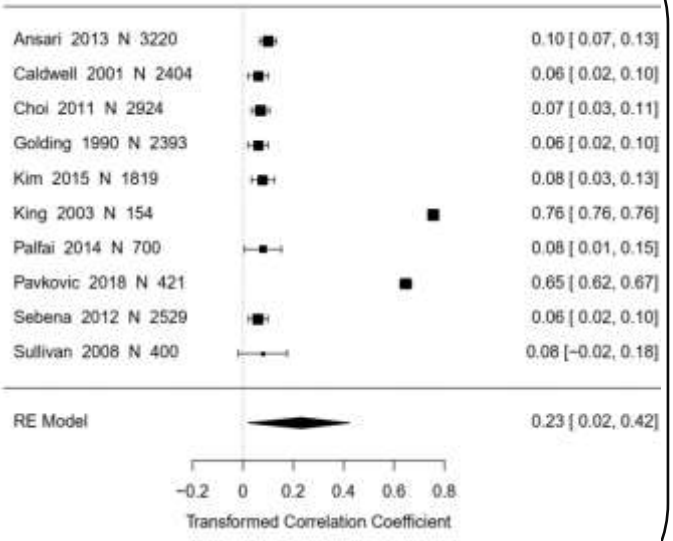


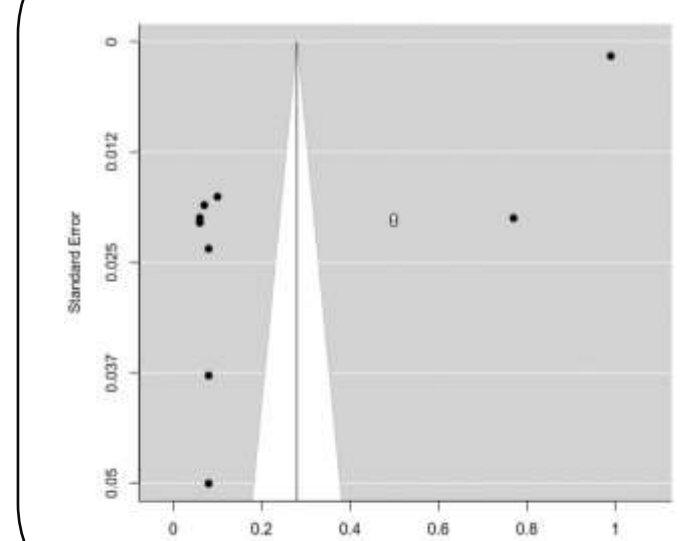
Design





Adjusted





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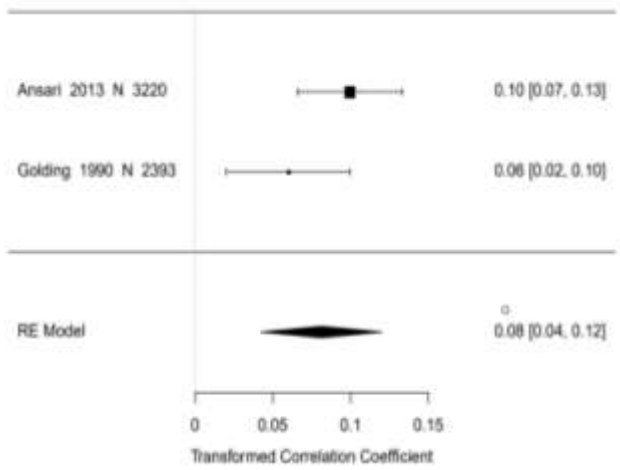

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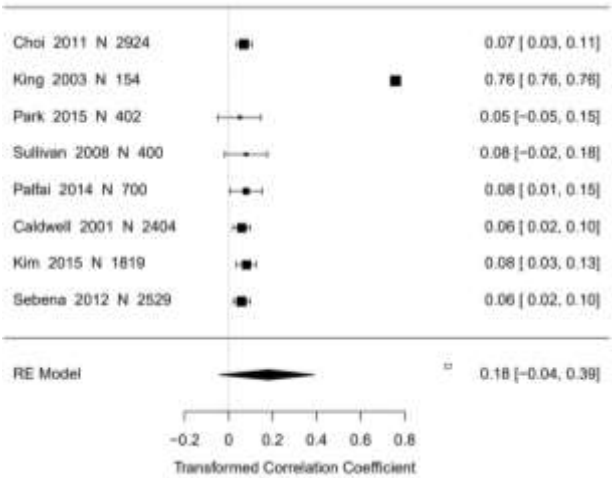

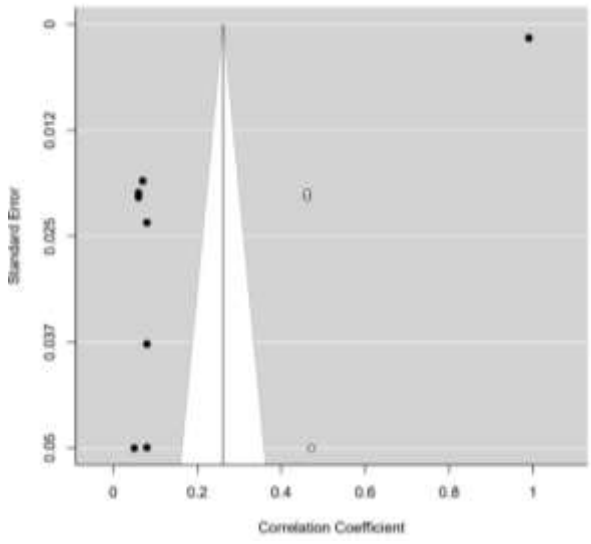

Appendix M – PRISMA Checklist

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	171
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	15
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	21
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	21
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	21
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	22
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	21, 23
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	22, Appendix C & D
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	24

Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	25
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	25
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	25
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	26
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	27, 28

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	28
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	27
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	24
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	34
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	39
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	40-41
Synthesis of results	21	Present the main results of the review for each meta-analysis done, including confidence intervals and measures of consistency.	40

Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	43
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	41, 47
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	53
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	55
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	58, 59
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	NA

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit: **www.prisma-statement.org**.

Section 2 – Empirical study

Abstract

Objectives: The research aimed to investigate alcohol use and severity of dependence on the number of psychological therapy contacts attended, and clinical outcomes after therapy in a stepped care mental health service. **Methods:** Participants accessing treatment for common mental health problems within a primary care setting were recruited. Data were collected for number of contacts attended, severity of anxiety (GAD-7), severity of depression (PHQ-9), weekly alcohol use (units), age, gender, ethnicity, employment status, functional impairment, self-reported disability, and outcome expectancy. A hierarchical regression model was used to analyse data. **Results:** *N*=7,986 participants, aged 16-89 years (*n*=2,760 male) participated. 195 participants completed the severity of dependence scale (SDS). After controlling for confounders, alcohol use was associated with baseline depression in a cubic model (R^2 =0.54, F(9, 7,440), =951.65, p<0.01), and post-treatment anxiety in a quadratic model (R^2 =0.23, F(10, 7,209), =218.61, p<0.01). Alcohol use was not associated with baseline anxiety, post treatment depression or contacts attended after controlling for independent variables. SDS was not associated with depression severity, alcohol severity, or total contacts after controlling for independent variables. **Conclusion:** Participants who drank moderately and extremely hazardously had lower baseline depression scores when compared to those who drank at low levels and hazardously. Participants who drank moderately had lower post-treatment anxiety scores when compared to those who drank at low and hazardous levels. Both relationships were controlled by variables; expectancy, age, baseline anxiety, functional impairment, disability, employment status, expectancy, baseline depression (post-treatment anxiety only), and ethnicity (post-treatment anxiety only).

Practitioner points

- Alcohol use and common mental health problems are often comorbid. It would be useful to treat both difficulties at the same time, using a holistic model to take the participant characteristics into account.
- Mental health services should consider the relationship between alcohol use and baseline depression severity with caution, as this was influenced by age, baseline anxiety, functional impairment, disability, expectancy, and employment status.
- Following psychological treatment, participants with either low or high levels of alcohol consumption were more likely to have higher anxiety scores, which were influenced by participant characteristics. Therefore, this information could be used to develop relapse prevention plans.
- Baseline anxiety, post-treatment depression, or contacts attended do not appear to be associated with alcohol consumption. Services could consider this when thinking about excluding a person from the service due to alcohol use.

Limitations

- A large sample of participants was analysed, however only *n*=195 participants completed the SDS. The service eligibility criteria for completing the SDS was drinking to excess, therefore this may restrict the conclusions and skew data.
- The sample was limited to an outpatient primary care mental health service.
- Outcome measures are self-reported, and participants may provide inaccurate information.

Key words: Alcohol, depression, anxiety, IAPT, dual diagnosis

Associations between alcohol use, depression and anxiety outcomes in a primary care psychological therapy service

Depression, anxiety, and substance use disorders are the most prevalent and often disabling mental health and behavioural problems. According to the UK Adult Psychiatric Morbidity Survey (APMS; Stansfeld, et al., 2016), approximately one in six (17%) adults met diagnostic criteria for common mental health problems (CMHP) related to depression or anxiety symptoms. Interestingly, depression is one of the most common causes of disability worldwide (Mathers, Boerma, & Ma Fat, 2008), with around 19.7% of adults drinking alcohol at levels above the recommended guidance (Drummond, McBride, Fear, & Fuller, 2016). The 1995-2016 alcohol consumption guidelines indicated that hazardous drinking for males was between 21-50 units of alcohol a week, and harmful drinking was more than 50 units of alcohol. For females hazardous drinking was classed as drinking between 14-35 units of alcohol per week, and harmful drinking was more than 35 units of alcohol per week (Institute of Alcohol Studies, 2018).

When a mental health difficulty and substance use difficulty co-exist, this is often referred to as a Dual Diagnosis (DD; Klimkiewicz et al., 2015). This term is widely used, definitions range and can include both severe mental health problems (e.g. psychosis) and CMHP (Hamilton, 2014). According to epidemiological surveys, 25% to 50% of substance users have a DD (Teesson et al., 2012), and dependent substance users are 5 times more likely to have a CMHP compared to non-substance-users (Merikangas et al., 1998).

The health and social impact of DD has been associated with increased risk of relapse, hospitalisation, suicide, and increased treatment costs when compared to someone with a single diagnosis (Ford, Snowden, & Walser, 1991; Hasin, Lie, Nunes, McCloud, Samet, & Endicott, 2002; McKay, Pettinati, Morrison, Feeley, Mulvaney, & Gallop, 2002; Mueser, Noordsy, Drake, & Fox, 2003). People with a DD face social difficulties including poor wellbeing, poor health related quality of life, and increased difficulty in accessing services (Lozano, Rojas, & Fernández-Calderón, 2017; Ujhelyi, Carson, & Holland, 2016).

Consequently, clinical guidelines recommend that DD should be recognised, assessed and treated using an integrated care plan supported by mental health and addiction specialists (Department of Health, 2002). Despite the growing evidence for effective psychological interventions for DD (Delgadillo & Kay-Lambkin, 2016), most mainstream healthcare services have been failing to heed the existing evidence base over the past decade (Drake et al., 2001; Tiet & Mausbauch, 2007; van Wamel, van Rooijen, & Kroon, 2015). In the UK for example, only 1 in 5 people (20%) involved with community drugs services were reported to access mental health treatment (Marsden et al., 2000), despite the high prevalence of CMHP in UK addiction treatment, which is typically around 70% (Delgadillo, Godfrey, Gilbody, & Payne, 2013). This is likely to be explained partly by deficits in screening and assessment practices (Weaver et al., 2003), but also may be due to a common tendency for services to exclude patients with DD from treatment (Department of Health, 2002), based on the assumptions that (a) people with DD may not engage with mainstream treatments and require highly specialist care; and (b) people need to quit or stabilise their substance use before they

can benefit from psychological treatment. These two assumptions are commonly held by healthcare providers and influence decisions about suitability and access to care.

Regarding the first assumption, there is some evidence that some people with addictions and CMHP are likely to drop out or fail to access treatment. It has been reported that dropout rates for drug treatment range from 9.6 % in a community drug treatment programme (Beynon, Bellis, & McVeigh, 2006) to 47% for a residential treatment programme (Meier, Donmall, McElduff, Barrowclough, & Heller, 2006). Dropout rates for psychological treatment in drug users has been reported to be as high as 58% (Delgadillo et al., 2015). The second assumption, however, appears to have mixed evidence. Recent systematic reviews of clinical trials for DD generally support the efficacy of psychological interventions, although they tend to report modest effect sizes more than those observed in conventional trials of psychotherapy for CMHP (Baker, Thornton, Hiles, Hides, & Lubman, 2012; Hides, Samet, & Lubman, 2010). This might suggest that treatment outcomes for CMHP are reduced in the presence of substance use. However, few studies have actually investigated correlations between level of substance use or dependence and mental health outcomes.

Wolitzky-Taylor et al. (2015) suggested that alcohol use at a non-dependent level has a minimal impact on the effectiveness of Cognitive Behavioural Therapy (CBT) and/or medication, although this study excluded people who met full criteria for alcohol dependence. Similarly, Delgadillo et al. (2015) reported moderate within-group effects suggesting that brief psychological interventions can be helpful in relieving

depression symptoms in drug and alcohol users, also excluding participants with severe substance dependence. More recently, Delgadillo et al. (2016) carried out a factor analysis of CMHP, substance use and dependence measures from a large sample of substance users in community drugs treatment. Their results indicated that few and relatively weak correlations were found between specific CMHP symptoms and level of substance use, but severity of dependence was moderately correlated with both CMHP and level of substance use. These findings suggest that dependence may be a more important determinant of treatment outcomes, and the actual level of substance use is less important in guiding prognostic or suitability assessments.

Treatment approach

There are many services available to treat substance use; these services are often council funded, such as North Yorkshire Horizons (2020), which is run by the council and charitable organisations. The company proposes that part of its future developments will include joint working with mental health services through the National Health Service (NHS). However, this is not currently in place and the situation is similar in many other counties. Most substance use services do not routinely offer clients with a DD access to their services or treatment for mental health difficulties, despite guidance suggesting that interventions should be integrated (NICE, 2016).

Similarly, in mental health services such as *Improving Access to Psychological Therapies* (IAPT) clients can be excluded on the basis of their substance use, and referred to specialist services (Care Quality Commission, 2015). Equally, people with severe mental health problems may not be eligible for substance use services,

however, the severity of their difficulties does not meet the criteria for secondary services, and they can be excluded from numerous services. Despite some guidance suggesting that treatment should be integrated, this is not routine practice (Public Health England, 2017). It has been suggested that DD clients are often very complex and have poor treatment outcomes.

Furthermore, many mental health clinicians lack confidence in working with people who use substances. It has been found that the whole team needs to adopt the same philosophy and understanding of clients with a DD to encourage a change in the overall service treatment philosophy (Graham, 2004). Clinicians often perceive that the greater the severity of substance use, the greater the severity of mental health difficulty, and the more difficult it is to have a successful outcome of an intervention (Care Quality Commission, 2015). The rationale for the analysis is to investigate any associations between alcohol use and severity of depression, which will provide clinical implications to enable clinicians to work more effectively with this client group.

In summary, CMHP and addiction problems often co-occur, leading to considerable burden and disability. People with DD can often struggle to access and engage with healthcare services, partly because of the assumptions that influence the attitude and inclusion criteria used by healthcare practitioners. Two prominent assumptions are that people with DD are less likely to engage with psychological treatment and less likely to benefit from it if they use substances frequently or in a dependent way. This study aimed to test these assumptions using routinely collected

data from a cohort of patients with CMHP treated in a primary care psychological service.

Aims and objectives

The overall aim of the study is to investigate whether alcohol use and severity of use influences psychological treatment utilisation and clinical outcomes. The following research questions, objectives and hypotheses were devised to operationalise this:

Research question 1: Is there an association between self-reported alcohol use and the baseline severity of depression and anxiety symptoms? Objective 1: Investigate associations between level of alcohol use and baseline severity of depression and anxiety symptoms, whilst controlling for potential confounders. Hypothesis 1: There will be a statistically significant, non-linear association between alcohol level and baseline severity of depression and anxiety symptoms.

Research question 2: Is there an association between self-reported alcohol use and attendance rates in psychological treatment? Objective 2: Investigate associations between level of alcohol use and treatment attendance, whilst controlling for potential confounders. Hypothesis 2: There will be a statistically significant negative association between alcohol use and treatment attendance.

Research question 3: Is there an association between self-reported alcohol use and post-treatment severity of depression and anxiety symptoms? Objective 3: Investigate associations between level of alcohol use and post-treatment severity of depression and anxiety symptoms, whilst controlling for potential confounders. Hypothesis 3: Linear associations between alcohol use and post-treatment symptom severity will not be statistically significant.

Research question 4: Is there an association between severity of alcohol dependence and the baseline severity of depression and anxiety symptoms? Objective 4: Investigate associations between the Severity of Dependence Scale (SDS) and baseline severity of depression and anxiety symptoms, whilst controlling for potential confounders. Hypothesis 4: There will be a statistically significant association between the severity of dependence scale and baseline severity of depression and anxiety symptoms.

Research question 5: Is there an association between severity of alcohol dependence and attendance rates in psychological treatment? Objective 5: Investigate associations between the Severity of Dependence Scale (SDS) and treatment attendance, whilst controlling for potential confounders. Hypothesis 5: There will be a statistically significant negative association between the severity of dependence scale and treatment attendance.

Research question 6: Is there an association between severity of alcohol dependence and post-treatment severity of depression and anxiety symptoms?

Objective 6: Investigate associations between the Severity of Dependence Scale (SDS) and post-treatment severity of depression and anxiety symptoms, whilst controlling for potential confounders. Hypothesis 6: Linear associations between severity of dependence and post-treatment depression or anxiety symptoms will not be statistically significant.

Methodology

Rationale

As described above, there is mixed evidence on the association between substance use, CMHP symptoms, and treatment attendance. This study sets out to reduce this gap in the evidence base and provide recommendations for clinicians delivering interventions for DD.

Participants

All participants were recruited from a primary care psychological therapy service in the North of England, which was part of the IAPT programme. IAPT was set up in 2008 to provide evidence-based psychological treatments for common mental health problems (NICE, 2011). Like most IAPT services, this service excludes people with severe mental health problems, acute suicidal risk, and those aged 16 or under.

The service is part of the national IAPT programme and delivers evidence-based treatment as part of a stepped care model (NICE, 2011). People are generally screened by a low intensity worker, a Psychological Wellbeing Practitioner (PWP). After screening people can access guided self-help with a PWP, and those who do not

benefit from low intensity interventions can be stepped-up to high intensity interventions (HII). HII include CBT, counselling, interpersonal psychotherapy, dynamic interpersonal therapy, and eye-movement desensitization and reprocessing (EMDR). Staff delivering HII include psychotherapists and counsellors with training in their specific models to post graduate level. PWP's have undergone an intensive 1-year training course, achieving a post-graduate certificate.

The available routinely collected data consists of 7,986 cases with complete assessment and treatment data and were therefore used to test the hypotheses. The data were collected from 07/2011-03/2016 as part of routine care.

All patients accessing the service were provided with an information leaflet (Appendix A) prior to assessment, detailing that their anonymised data may be used for research purposes and service evaluation. Patients had the option to withdraw consent. The study dataset therefore contains no data for patients who opted out of usual data sharing procedures (the number of those who withdrew their data is unknown, because of confidentiality). Ethical approval for the analysis of this dataset was obtained from an NHS research ethics committee (North East-Newcastle & North Tyneside) and approved by the Health Research Authority (REC Reference: 15/NE/0062).

Using an *a priori* sample size calculator for multiple regression (Sopher, 2017) the minimum sample size required when using a probability level of 0.05, anticipated effect size of 0.17 as calculated from the regression outputs reported by Delgadillo,

Moreea, and Lutz (2016) and a desired statistical power level of 0.8 (Cohen, 1988), would be 98 participants (Appendix B).

Data collection procedure

The study is based on data from a consecutive sample of people entering into the service. All clients accessed a standard screening appointment before entering into treatment. The screening involved a 45-60 minute semi-structured interview with a mental health practitioner to assess symptoms of CMHP, alcohol use and dependence (if applicable) as described below. If a client considered themselves to be dependent on alcohol, they could opt for treatment within the primary care team and/or treatment with a Drug and Alcohol team.

Outcome measures

During the initial assessment to assess a persons' mood, the Physical Health Questionnaire-9 (PHQ-9; Appendix C) is used to screen for major depressive disorder. This is a 9-item, self-reported questionnaire, scored on a scale of 0-3, with a total severity score out of 27. The diagnostic cut off is suggested at ≥10. This test has adequate sensitivity (88%) and specificity (88%; Kroenke, Spitzer, & Williams, 2001). This tool also has good construct validity at identifying major depression in the general population (Martin, Rief, Klaiberg, & Braehlet, 2006). The PHQ-9 has been shown as an appropriate screening tool for monitoring outcomes in people with depression who use substances (Delgadillo, et al., 2011).

The Generalised Anxiety Disorder-7 (GAD-7) is a self-reporting questionnaire used to screen for anxiety disorders (Appendix D). This has seven items, scored on a scale of 0-3, with a total severity score between 0-21. A score of ≥8 is considered to indicate the presence of an anxiety disorder. The GAD-7 has adequate sensitivity (77%) and specificity (82%; Spitzer, Kroenke, Williams, & Lowe, 2006). This has been proven to be a useful screening measure for populations seeking treatment for anxiety alongside using substances (Delgadillo et al., 2012).

To assess a patient's level of alcohol use a screening question was administered during the initial assessment. The alcohol screening question is based on the Treatment Outcomes Profile that is a validated questionnaire to gain information about substance use (Marsden et al., 2008). The question was, 'Do you drink alcohol?', If a patient answered, 'yes', then the clinician would clarify the average alcohol units per week in the last month (Appendix E). If a person drank more than the recommended number of units of alcohol per week, 14 for females and 21 for males (Anderson, 1996), they were asked to complete the SDS (Gossop et al., 1995; Appendix F). The guidelines for recommended units of alcohol have now changed, however this was accurate when the data was collected. On the SDS if a patient scored in the severe range of ≥10, a discussion was held with the client around the most suitable service to deliver an intervention.

The SDS is a short 5-item questionnaire to assess the severity of dependence. This tool can be used for a variety of different substances and is scored using 0-3, with a total score of 15. The higher the score, the higher the level of dependence indicated.

The tool has been shown to have good psychometric properties (Gossop et al., 1995). A score of three or more would indicate alcohol dependence (Lawrinson, Copeland, Gerber, & Gilmour, 2007). The SDS has been validated for use with a wide range of client groups and with different substances e.g. within an adolescent population (Martin, Copeland, Gates, & Gilmour, 2006) and with khat users (Kassim, Islam, & Croucher, 2010). Within the routine data collection in IAPT this tool was only used selectively, with heavy drinkers, as per the screening method described above.

The outcome expectancy measure (Lutz, Leon, Martinovich, Lyons, & Stiles, 2007; Appendix G) asked patients, 'How confident are you that psychological treatment will work for you?', and they were asked to indicate a response from 0-10; 0 is low expectancy and 10 is high expectancy for therapy. The outcome expectancy measure is an established predictor of treatment outcome in a primary care setting (Delgadillo, Moreea, & Lutz, 2016).

The Work and Social Adjustment Scale (WSAS) is a self-completed measure based on different day to day activities of work, home management, social activities, private leisure pursuits, and close relationships (Appendix H). These areas are set as five items and scored using an 8-point Likert Scale; 0 indicates not at all, and 8 indicates a very severe functional impairment. Scores range from 0-40; scores less than 10 are generally associated with subclinical populations, a score of 10-20 is associated with significant functional impairment alongside clinical symptomology, and scores above 20 suggest moderately severe psychopathology. The WSAS was found

to be a reliable and valid tool to use to monitor levels of functioning (Mundt, Marks, Shear, & Greist, 2002).

The outcome measures and the number of units of alcohol consumed per week all provide quantitative data. Most outcome measures were monitored weekly, however the level of alcohol use, outcome expectancy and SDS were measured once at baseline.

Ethical considerations

Participants were given an information sheet as previously mentioned, to outline the reasons for data collection and information about withdrawing data, confidentiality and anonymity.

As the proposed research project was to analyse pre-existing routinely collected data, minimal ethical dilemmas are identified. The database has pre-existing ethical permission to be used for further analyses, such as this analysis (Appendix I). In addition, confirmation of Scientific Approval and Indemnity was gained from the University of Sheffield, Clinical Psychology Department (Appendix J).

Data security

The collected data is in an anonymised computer database, stored securely in line with the Data Protection Act (HM Government, 2018). The database is stored in a password protected file on the University of Sheffield network, only accessible to the primary investigator and supervisor.

Analysis

General considerations and modelling strategy

The data analysis was based on a hierarchical multiple regression strategy, with backward elimination, where relationships between variables of interest (alcohol use, dependence, depression, anxiety, attendance) were examined whilst controlling for the influence of potential confounding variables. Based on prior findings in similar settings (IAPT) and using the same outcome measures (PHQ-9, GAD-7), potentially confounding variables are: baseline severity of anxiety/depression, baseline WSAS, age, self-reported disability, employment status, outcome expectancy, and ethnicity.

The relationship between alcohol use, depression and anxiety severity has been previously investigated, and several studies have suggested the relationship was non-linear, following a curvilinear pattern (e.g. see Delgadillo et al., 2012), therefore it was important to account for potential non-linear relationships in the analysis. Linear, cubic and quadratic terms were calculated to investigate potential linear and nonlinear associations.

Data were analysed using the Statistical Package for Social Science (SPSS) version 26 (IBM Corp, 2019). Descriptive statistics were calculated for the database and tests of normality (skewness, kurtosis and Shapiro-Wilks) were considered, alongside inspecting histograms and Q-Q plots.

The hierarchical regression strategy, planned *a priori,* entered different variables into regression models in four blocks. Block 1 entered the independent (i.e. alcohol level) and dependent variable (i.e. baseline PHQ-9); block 2 additionally entered a quadratic term for the independent variable (i.e. alcohol level) to examine non-linear relationships; block 3 additionally entered a cubic term for the independent variable (i.e. alcohol level) to examine non-linear relationships; and block 4 entered all potentially confounding variables described above. This regression strategy then utilised backward elimination to remove any variables that were not statistically significant ($p \leq 0.05$). This enabled a robust examination of relationships with and without the influence of other known correlates of psychological treatment outcomes.

Goodness of fit tests were conducted, including the Akaike information criterion (AIC; Akaike, 1974), Bayesian information criterion (BIC; Burnham & Anderson, 2004), and -2 log likelihood ratio test (Woolf, 1957). The examination of these indices provided an indication of whether alcohol level modelled as a linear or non-linear factor offered a better fit to the data.

To investigate associations between level of alcohol use with depression and anxiety symptoms, the baseline score (e.g. PHQ-9, GAD-7) was taken as the

dependent variable in the regression models, with separate models to examine depression and anxiety. The independent variable was baseline alcohol use expressed in average weekly alcohol units. This was repeated using post-treatment symptom severity scores as the dependent variable.

To investigate associations between level of alcohol use and treatment attendance, the number of treatment sessions attended was taken as the dependent variable in the regression models. The independent variable was baseline alcohol use, expressed in average weekly alcohol units.

For the remaining objectives, the SDS was investigated instead of alcohol use, using a subsample of *n*=195 participants with a completed SDS. To investigate associations between the SDS and baseline severity of depression and anxiety symptoms, whilst controlling for potential confounders, the baseline symptom severity (e.g. PHQ-9, GAD-7) was taken as the dependent variable in the regression models. The independent variable was SDS score. This was repeated using the post-treatment symptom severity scores as the dependent variable.

To investigate associations between the SDS and treatment attendance, whilst controlling for potential confounders, the SDS was the independent variable of interest, and number of treatment sessions attended was the dependent variable in the regression model.

Results

Data from 7,986 participants were analysed using SPSS. Descriptive statistics, assumption testing, simple correlations, regression models, and goodness-of-fit tests will be described.

Descriptive statistics

The data set had *n*=7,986 participants of which *n*=2,760 (34.6%) were male. All participants engaged in at least two sessions of therapy, this ranged from 2-39 sessions. Participants were recruited from 20.06.2011-23.03.2016, as shown in table 1. The participants were between 16-89 years old and had a range of difficulties, including depression (18.7%), generalized anxiety disorder (8.7%), and mixed anxiety and depression (32.2%). Other key characteristics were monitored, including unemployment (20.1%), white British ethnicity (90.3%), and whether a participant classed themselves as disabled (13.4%; see table 2).

The participants' scores ranged greatly on the outcome measures. Prior to treatment, the mean score on the PHQ-9 was 15.06 (6.06); a score of $\geq$10 indicates the recommended cut off score for depression. Participants' scored 9.17 (6.87) on the GAD-7; a score of $\geq$8 is the recommended cut off score for anxiety. Following treatment, participants' scores generally reduced, and mean scores were 9.17 (6.87) on the PHQ-9 and 8.27 (5.97) on the GAD-7. There was also a decline in score on the WSAS; the baseline mean score was 19.66 (8.96), and this reduced to 13.51 (9.82) post-treatment. A score between 10-20 is associated with significant functional impairment alongside clinical symptomology (see table 3).

When asked about drinking alcohol, a total of *n*=4,630 (58%) of participants reported current alcohol use. This ranged from 0-110 units per week, with an average of 5.31 (10.02). To assess the severity of alcohol use, *n*=195 participants who drank above the recommended guidelines were asked to complete the SDS scale. A total of *n*=10 participants had a completed SDS based on drug use rather than alcohol use, so these cases were removed from the SDS analysis. The date ranges, demographic characteristics and outcome measure scores are available in tables 4-6.

The participants who completed the SDS, *n*=195 (49.2% male) were aged between 17-78 years old. Baseline anxiety and depression scores were 15.51 (5.86) and 13.69 (4.61). Post-treatment depression and anxiety scores were 9.92 (7.23) and 8.73 (5.98). Alcohol use ranged from 0-100 units per week, and SDS scores ranged from 0-14, with a mean score of 3.91 (3.27).

Table 1

Date range for alcohol use

	n (%)	Date
Referral date	7986 (100)	20.06.2011-11.11.2015
Initial assessment date	7983 (99.9)	15.07.2011-11.11.2015
Discharge date	7702 (96.4)	14.02-2012-23.03.2016

Table 2

Demographic characteristics for alcohol use

Characteristic		*n* (%)	Range	Mean	SD
Age (years)		7986 (100)	16-89	37.24	13.87
Gender		7985 (99.9)			
	Male	2760 (34.6)			
	Female	5225 (65.4)			
Diagnosis		7570 (94.8)			
	Depressive episode	1495 (18.7)			
	Recurrent depression	275 (3.4)			
	Mixed anxiety & depression	2569 (32.2)			
	GAD	698 (8.7)			
	Social phobia	182 (2.3)			
	Panic disorder	270 (3.4)			
	Agoraphobia	59 (0.7)			
	Specific phobia	78(1.0)			
	OCD	182 (2.3)			
	PTSD	132 (1.7)			
	Bereavement	39 (0.5)			
	Eating disorder	42 (0.5)			
	Alcohol related mental or behavioural disorder	10 (0.1)			
	Somatoform disorder	57 (0.7)			
	Bipolar affective disorder	2 (0.0)			
	Not specified	1355 (17.0)			
	Does not meet diagnostic criteria for CMD	125 (1.6)			
Ethnicity		7986 (100)			
	White British	7210 (90.3)			
	Other	776 (9.7)			
Employment		7986 (100)			
	Unemployed	1605 (20.1)			
	Other	6381 (79.9)			
Disability		7986 (100)			
	Disabled	1074 (13.4)			
	Not disabled	6912 (86.6)			

Notes: GAD: Generalised anxiety disorder; OCD: Obsessive compulsive disorder;

PTSD: Post traumatic stress disorder; CMD: Common mental health disorder;

SD: Standard deviation

Table 3

Outcome measures for alcohol use

Variables		*n* (%)	Range	Mean	SD
No. of contacts		7986 (100)	2-39	7.78	5.73
Expectancy		7986 (100)	0-10	7.39	1.82
Baseline depression		7986 (100)	0-27	15.06	6.06
Post-treatment depression		7726 (96.7)	0-27	9.17	6.87
Baseline anxiety		7986 (100)	0-21	13.67	4.82
Post-treatment anxiety		7729 (96.7)	0-21	8.27	5.97
WSAS		7986 (100)	0-40	19.66	8.96
Alcohol use	Total	7986 (100)			
	Yes	4630 (58)			
	No	3356 (42)			
Alcohol units per week	Total	7450 (93)	0-110	5.31	10.02
SDS	Total	195 (2.4)	0-14	3.91	3.28

Notes: SD: Standard deviation; WSAS: Work and social adjustment scale;

SDS: Severity of dependence scale

Table 4

Date range for SDS

Date	*n* (%)	Range
Referral date	195 (100)	24.10.2011-23.10.2015
Initial assessment date	195 (100)	24.11.2011-27.10.2015
Discharge date	188 (96.4)	08.08.2012-21.12.2015

Table 5

Demographic characteristics for SDS

Characteristic		*n* (%)	Range	Mean	SD
Age (years)	Total	195 (100)	17-78	38.44	12.8
Gender	Total	195 (100)			
	Male	96 (49.2)			
	Female	99 (50.8)			
Diagnosis	Total	187 (95.9)			
	Depressive episode	37 (19.8)			
	Recurrent depression	6 (3.2)			
	Mixed anxiety & depression	66 (35.3)			
	GAD	11 (5.9)			
	Social phobia	4 (2.1)			
	Panic disorder	5 (2.7)			
	Agoraphobia	1 (0.5)			
	Specific phobia	1 (0.5)			
	OCD	4 (2.1)			
	PTSD	3 (1.6)			
	Bereavement	1 (0.5)			
	Eating disorder	1 (1.1)			
	Alcohol related mental or behavioural disorder	1 (0.5)			
	Not specified	43 (23.0)			
	Does not meet diagnostic criteria for CMD	2 (1.1)			
Ethnicity	Total	195 (100)			
	White British	182 (93.3)			
	Other	13 (6.7)			
Employment	Total	195 (100)			
	Unemployed	46 (23.6)			
	Other	149 (76.4)			
Disability	Total	195 (100)			
	Disabled	28 (14.4)			
	Not disabled	167 (85.6)			

Notes: GAD: Generalised anxiety disorder; OCD: Obsessive compulsive disorder; PTSD: Post traumatic stress disorder; CMD: Common mental health disorder; SD: Standard deviation

Table 6

Outcome measures for SDS

Variables	*n* (%)	Range	Mean	SD
No. of contacts	195 (100)	2-34	7.91	6.66
Expectancy	195 (100)	1-10	7.37	1.78
Baseline depression	195 (100)	0-27	15.51	5.86
Post-treatment depression	183 (93.8)	0-27	9.92	7.23
Baseline anxiety	195 (100)	0-21	13.69	4.61
Post treatment anxiety	184 (94.4)	0-21	8.73	5.98
WSAS Pre	195 (100)	0-40	20.18	8.73
Alcohol units per week	181 (92.8)	0-100	28.69	20.55
SDS	195 (100)	0-14	3.91	3.28

Notes: SD: Standard deviation; WSAS: Work and social adjustment scale;

SDS: Severity of dependence scale

Assumption testing

The dataset was analysed for normality of variance and homogeneity of variance. Normal data distribution was assessed using visual interpretation of histograms and Q-Q plots, alongside the skewness, kurtosis and Shapiro-Wilks test. It is advised that for large samples of $n \geq 200$ participants, the tests do not inform the researcher if the deviation from the norm will bias the statistical tests used for analysis, and visual outputs should be considered, rather than the statistical significance. The distribution of measures was examined visually and statistically prior to analysis to inform the use of further parametric or non-parametric tests.

Visual examination of the data and tests of normality and homogeneity suggest that the data violate these assumptions and are not normally distributed, therefore non-parametric tests were applied in further analyses (Brown, 2019).

Correlation between study variables

Due to the data violating assumptions of normality, non-parametric tests are appropriate to investigate the data. The Spearman's Rho correlation coefficient was calculated to explore the relationship between the baseline variables, as shown in table 7.

When exploring the results of the simple correlations it is interesting to note that there was a statistically significant difference between male and female drinking patterns, whereby males consumed significantly more units of alcohol per week than females. Those who were employed, did not identify as disabled, or people of white British ethnicity, consumed significantly more units of alcohol per week than their matched counterparts. As participants' age increased, they tended to drink more units of alcohol per week. Participants who were older, female, or employed were significantly more likely to attend a greater number of sessions when compared to their counterparts. The baseline and post treatment scores for depression, anxiety and functional impairment indicated that there was a statistically significant difference between baseline and post treatment scores, showing a general decrease in symptoms of anxiety, depression, and functional impairment.

When exploring the data for SDS, it appears that people were more likely to be dependent on alcohol if they experienced a greater severity of anxiety, depression, and WSAS. Also, there was a significant positive association between age and SDS score.

The majority of the significant relationships identified a small correlation co-efficient. Some variables had a medium correlation, including the associations between alcohol use per week and SDS, age and number of contacts attended, baseline depression score and post-treatment anxiety, post-treatment depression and baseline anxiety, post-treatment depression and WSAS, baseline anxiety, and both post-treatment anxiety and WSAS, and post-treatment anxiety and WSAS.

Three variables had medium to large significant positive correlations, including the baseline depression score correlated independently with post-treatment depression, WSAS, and baseline anxiety.

The number of alcohol units consumed weekly inferred a large, positive association with disability status and alcohol use binary measure (as expected). This was similar for post-treatment depression and post-treatment anxiety score. One perfect correlation was identified between the SDS and alcohol use binary measure, as the SDS is only completed with people who drink alcohol.

Table 7

Correlation between study variables

	Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Alcohol (units per week)															
2	Age (years)	0.03*														
3	Gender	-0.13**	-0.05**													
4	Diagnosis	0.02	-0.07**	0.00												
5	Ethnicity	-0.11**	-0.05**	0.01	-0.01											
6	Employment status	-0.13**	0.04**	-0.10**	-0.05**	0.05**										
7	Disability	-0.78**	0.18**	-0.04**	-0.03**	-0.01	0.21**									
8	No. of contacts	0.00	0.34**	0.03**	-0.01	-0.02	-0.08**	-0.00								
9	Expectancy	-0.01	0.01	0.05**	0.03**	-0.01	-0.09**	-0.04**	0.03**							
10	Baseline depression	-0.11**	0.05**	0.01	-0.22**	0.06**	0.23**	0.14**	-0.00	-0.06**						
11	Post-treatment depression	-0.09**	-0.04	0.00	-0.11**	0.08**	0.26**	0.13**	-0.29**	-0.10**	0.48**					
12	Baseline anxiety	-0.09**	-0.01	0.05**	-0.03*	0.04**	0.15**	0.07**	0.02	0.01	0.62**	0.31**				
13	Post-treatment anxiety	-0.08**	-0.07**	0.02	-0.04**	0.07**	0.23**	0.10**	-0.30	-0.07**	0.38**	0.86**	0.39**			
14	WSAS	-0.11**	0.00	-0.01	-0.13**	0.07**	0.22**	0.11**	0.00	-0.06**	0.60**	0.37**	0.43**	0.31**		
15	Alcohol use	0.75**	0.04*	-0.09**	0.02	-0.11**	-0.15**	-0.09**	-0.00	0.02	-0.12**	-0.09**	-0.10**	-0.08**	-0.12**	
16	SDS	0.36**	0.28**	-0.05	-010	-0.03	0.12	0.08	-0.14	-0.06	0.21**	0.23**	0.15*	0.20**	0.27**	1.00**

Notes: *: $p<0.05$; **: $p<0.01$; WSAS: Work and social adjustment scale; SDS: Severity of dependence scale.

Regression models

To test hypothesis 1-3, a hierarchical regression was carried out. The predictor variables were entered into the model in blocks. In the first block a simple linear association was calculated between the dependent variable and the number of units of alcohol per week. In block two a quadratic term was added. Block three investigated the cubic term, and block four adjusted for all confounders. Once this model had been run, any non-significant confounders were removed in a backward elimination process (Field, 2009). A similar process was conducted for the SDS scale, for hypothesis 4-6.

Hypothesis 1

There will be a statistically significant, non-linear association between alcohol level and baseline severity of depression and anxiety symptoms.

Depression

In the hierarchical regression model, as shown in table 8, the first block accounted for 0.1% of the total variance, R^2=0.00, F(1, 7,448) =4.14, *p*=0.04. The second block accounted for 1% of the total variance, R^2=0.01, F(1, 7,447) =32.85, *p*<0.01. The third block accounted for 2% of the total variance, R^2=0.02, F(1, 7446) =41.32, *p*<0.01. The final block including moderators accounted for 54% of the total variance, R^2=0.54, F(7, 7,439), =856.90, *p*<0.01. Ethnicity was removed during the backward elimination model as this did not account for any of the variance within the model.

In the backward elimination model, the alcohol terms and all other variables tested within this model were of statistical significance, $p<0.01$. The model accounted for 53.5% of the total variance, $R^2=0.54$, F(9, 7,440), =951.65, $p<0.01$. Therefore, the number of alcohol units, in a linear, quadratic and cubic association was significantly associated with baseline depression score after controlling for variables. The cubic model accounted for the most variance, $R^2=0.02$, accounting for 1.6% of the total variance as shown in figure 1. The figure indicated the confidence intervals and as this is close to the line of best fit, would suggest that the data is more robust, although as the units of alcohol increase there is a greater amount of variance (Appendix K).

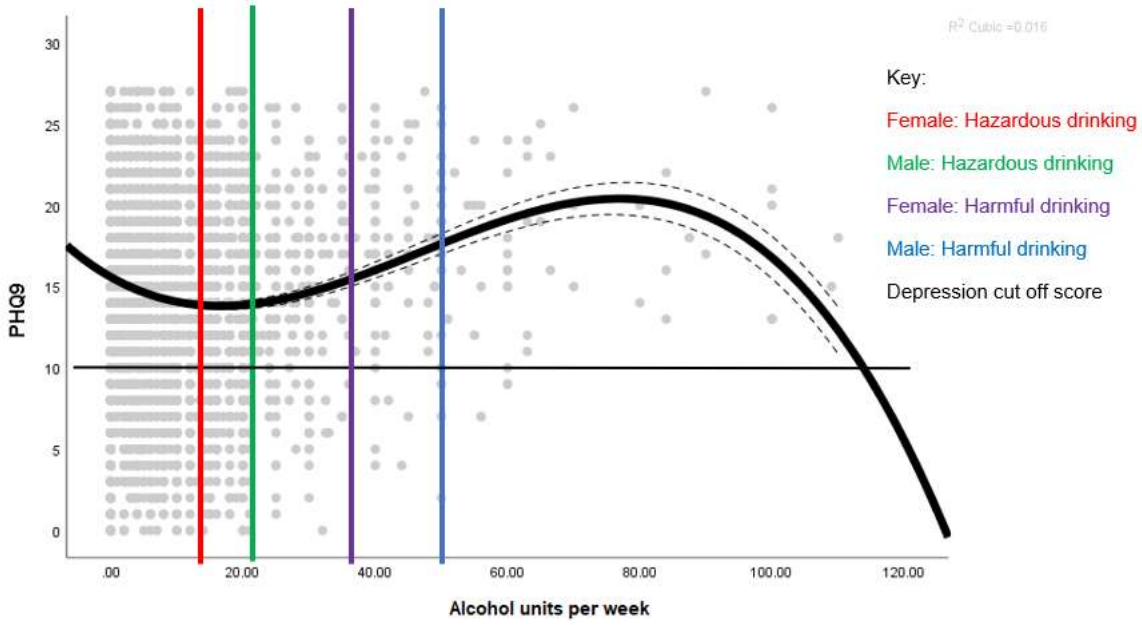

Figure 1. The cubic association between baseline depression and units of alcohol consumed per week

Table 8

Hypothesis 1 - Baseline depression and alcohol use per week

	Block	*B*	SE	*p*	CI L	CI U
1	Alcohol units	-0.01	0.01	0.04	-0.03	0.00
	R^2	0.00				
2	Alcohol units	-0.10	0.01	0.00	-0.13	-0.07
	Alcohol quadratic	0.00	0.00	0.00	0.00	0.00
	R^2	0.01				
3	Alcohol units	-0.23	0.02	0.00	-0.27	-0.19
	Alcohol quadratic	0.01	0.00	0.00	0.01	0.01
	Alcohol cubic	-6.01	0.00	0.00	0.00	0.00
	R^2	0.02				
4	Alcohol units	-0.06	0.02	0.00	-0.09	-0.03
	Alcohol quadratic	0.00	0.00	0.00	0.00	0.00
	Alcohol cubic	-2.02	0.00	0.00	0.00	0.00
	Age	0.02	0.00	0.00	0.01	0.03
	Ethnicity	0.25	0.16	0.12	-0.07	0.57
	Disability	0.71	0.15	0.00	0.42	1.00
	Employment	0.85	0.13	0.00	0.60	1.09
	Expectancy	-0.11	0.03	0.00	-0.16	-0.06
	Baseline anxiety	0.56	0.01	0.00	0.54	0.58
	WSAS	0.26	0.01	0.00	0.25	0.27
	R^2	0.54				
Final model	Alcohol units	-0.06	0.02	0.00	-0.09	-0.03
	Alcohol quadratic	0.00	0.00	0.00	0.00	0.00
	Alcohol cubic	0.00	0.00	0.00	0.00	0.00
	Age	0.02	0.00	0.00	0.01	0.03
	Disability	0.71	0.15	0.00	0.42	1.00
	Employment	0.85	0.13	0.00	0.61	1.10
	Expectancy	-0.11	0.03	0.00	-0.16	-0.06
	Baseline anxiety	0.56	0.01	0.00	0.54	0.58
	WSAS	0.26	0.01	0.00	0.25	0.27
	R^2	0.54				

Notes: B: Beta; SE: Standard Error; CI L: Confidence interval lower;
CI U: Confidence interval upper; WSAS: Work and social adjustment scale

Anxiety

In the hierarchical regression model, as shown in table 9, the first block accounted for 0.1% of the total variance, R^2=0.00, F(1, 7,448) =7.88, *p*<0.01. The second block accounted for 0.5% of the total variance, R^2=0.00, F(1, 7,447) =17.98, *p*<0.01. The third block accounted for 0.7% of the total variance, R^2=0.00, F(1, 7,446) =17.95, *p*<0.01. The final block including moderators accounted for 39.8% of the total variance, R^2=0.40, F(7, 7,439), =492.11, *p*<0.01. Alcohol use variables, ethnicity, disability, and unemployment were removed during the backward elimination as this did not account for any of the variance within the model when the remaining variables are controlled.

Therefore, the number of alcohol units consumed per week was not significantly associated with baseline anxiety score after controlling for variables. However, variables of age, expectancy, baseline PHQ-9, and WSAS were all significantly associated with baseline anxiety levels, accounting for 39.8% of the total variance.

Table 9

Hypothesis 1 - Baseline anxiety and alcohol use per week

	Block	*B*	SE	*p*	CI L	CI U
1	Alcohol units	-0.02	0.01	0.01	-0.03	0.00
	R^2	0.00				
2	Alcohol units	-0.06	0.01	0.00	-0.08	-0.04
	Alcohol quadratic	0.00	0.00	0.00	0.00	0.00
	R^2	0.01				
3	Alcohol units	-0.12	0.02	0.00	-0.15	-0.09
	Alcohol quadratic	0.00	0.00	0.00	0.00	0.01
	Alcohol cubic	-2.67	0.00	0.00	0.00	0.00
	R^2	0.01				
4	Alcohol units	-0.001	0.01	0.92	-0.03	0.03
	Alcohol quadratic	0.00	0.00	0.56	0.00	0.00
	Alcohol cubic	3.63	0.00	0.46	0.00	0.00
	Age	-0.02	0.00	0.00	-0.02	-0.01
	Ethnicity	-0.06	0.15	0.68	-0.35	0.23
	Disability	-0.18	0.13	0.17	-0.44	0.08
	Employment	0.02	0.11	0.88	-0.21	0.24
	Expectancy	0.12	0.02	0.00	0.07	0.17
	Baseline depression	0.46	0.01	0.00	0.44	0.47
	WSAS	0.05	0.01	0.00	0.04	0.06
	R^2	0.40				

Notes: B: Beta; SE: Standard Error; CI L: Confidence interval lower; CI U: Confidence interval upper; WSAS: Work and social adjustment scale

Hypothesis 2

There will be a statistically significant negative association between alcohol use and treatment attendance.

In the hierarchical regression model, as shown in table 10, the first block accounted for <0.00% of the total variance, R^2=0.00, F(1, 7,448) =1.68, *p*=0.20. The second block accounted for 0.1% of the total variance, R^2=0.00, F(1, 7,447) =2.16, *p*=0.12. The third block accounted for 0.1% of the total variance, R^2=0.00, F(1, 7,446) =1.51, *p*=0.21. The final block accounted for 0.7% of the total variance, R^2=0.00, F(8,

7,438), =4.59, p<0.01. Alcohol use variables were not associated with the number of contacts attended. The association was accounted for by independent variables: alcohol use, age, ethnicity, disability, expectancy, and baseline depression score. Alcohol use was not significantly associated when the remaining variables were controlled. Therefore, the number of alcohol units consumed per week was not significantly associated with the number of contacts attended. However, the variance was accounted for by variables: employment, baseline anxiety, and WSAS. These were all significantly associated with the number of contacts attended, and contributed to 0.7% of the total variance within the model.

Table 10

Hypothesis 2 - Contacts attended and alcohol use per week

	Block	*B*	SE	*p*	CI
1	Alcohol units	-0.01	0.01	0.20	-0.02 - 0.00
	R^2	0.00			
2	Alcohol units	0.01	0.01	0.50	-0.02 - 0.03
	Alcohol quadratic	0.00	0.00	0.11	-0.001 - 0.00
	R^2	0.00			
3	Alcohol units	0.00	0.02	0.98	-0.04 - 0.04
	Alcohol quadratic	2.73	0.00	0.98	-0.002 - 0.002
	Alcohol cubic	-3.51	0.00	0.64	0.00 - 0.00
	R^2	0.00			
4	Alcohol units	0.00	0.02	0.86	-0.04 - 0.04
	Alcohol quadratic	0.00	0.00	0.88	-0.002 - 0.002
	Alcohol cubic	-4.04	0.00	0.59	0.00 - 0.00
	Age	0.00	0.01	0.37	-0.01 - 0.01
	Ethnicity	-0.40	0.27	0.07	-0.85 - 0.04
	Disability	0.16	0.20	0.43	-0.24 - 0.56
	Employment	-0.81	0.17	0.00	-1.15 - -0.47
	Expectancy	0.06	0.04	0.11	-0.01 - 0.13
	Baseline depression	-0.03	0.02	0.10	-0.06 - 0.01
	Baseline anxiety	0.05	0.02	0.01	0.01 - 0.08
	WSAS	0.03	0.01	0.00	0.01 - 0.05
	R^2	0.01			

Notes: B: Beta; SE: Standard Error; CI: Confidence interval;
WSAS: Work and social adjustment scale

Hypothesis 3

Linear associations between alcohol use and post-treatment symptom severity will not be statistically significant.

Depression

In the hierarchical regression model, as shown in table 11, the first block accounted for 0.1% of the total variance, R^2=0.00, F(1, 7,215) =3.71, *p*=0.05. The second block accounted for 1% of the total variance, R^2=0.01, F(1, 7,214) =34.86, *p*<0.01. The third block accounted for 1.3% of the total variance, R^2=0.01, F(1, 7,213) =34.86, *p*<0.01. The final block including moderators accounted for 28.7% of the total variance, R^2=0.29, F(8, 7,205), =264.28, *p*<0.01. Alcohol quadratic term, alcohol cubic term, and baseline anxiety score were removed during the backward elimination.

In the final model, the linear term for alcohol units per week is no longer of statistical significance, *p*=0.50. Therefore, the number of alcohol units consumed per week was not significantly associated with post-treatment depression score after controlling for confounding variables. The regression coefficients for baseline anxiety, WSAS, age, disability, employment, ethnicity, and expectancy were all of statistical significance.

Table 11

Hypothesis 3 - Post-treatment depression and alcohol use per week

	Block	*B*	SE	*p*	CI L	CI U
1	Alcohol units	-0.02	0.01	0.05	-0.03	0.00
	R^2	0.00				
2	Alcohol units	-0.12	0.01	0.00	-0.15	-0.09
	Alcohol quadratic	0.00	0.00	0.00	0.00	0.00
	R^2	0.10				
3	Alcohol units	-0.22	0.02	0.00	-0.27	-0.18
	Alcohol quadratic	0.01	0.00	0.00	0.01	0.01
	Alcohol cubic	0.00	0.00	0.00	0.00	0.00
	R^2	0.13				
4	Alcohol units	-0.05	0.02	0.02	-0.09	-0.01
	Alcohol quadratic	0.00	0.00	0.07	0.00	0.00
	Alcohol cubic	0.00	0.00	0.32	0.00	0.00
	Age	-0.03	0.01	0.00	-0.04	-0.02
	Ethnicity	0.75	0.23	0.00	0.29	1.21
	Disability	1.14	0.21	0.00	0.73	1.56
	Employment	2.49	0.18	0.00	2.13	2.84
	Expectancy	-0.21	0.04	0.00	-0.29	-0.14
	Baseline depression	0.43	0.02	0.00	0.40	0.47
	Baseline anxiety	0.03	0.02	0.11	-0.01	0.06
	WSAS	0.07	0.01	0.00	0.05	0.08
	R^2	0.29				
Final model	Alcohol units	0.01	0.01	0.50	-0.01	0.02
	Age	-0.03	0.01	0.00	-0.04	-0.02
	Ethnicity	0.79	0.23	0.00	0.33	1.25
	Disability	1.17	0.21	0.00	0.76	1.58
	Employment	2.52	0.18	0.00	2.17	2.88
	Expectancy	-0.21	0.04	0.00	-0.29	-0.14
	Baseline depression	0.45	0.01	0.00	0.42	0.48
	WSAS	0.07	0.01	0.00	0.05	0.09
	R^2	0.29				

Notes: B: Beta; SE: Standard Error; CI L: Confidence interval lower;
CI U: Confidence interval upper; WSAS: Work and social adjustment scale;

Anxiety

In the hierarchical regression model, as shown in table 12, the first block accounted for <0.01% of the total variance, R^2=0.00, F(1, 7,218) =3.41, *p*=0.07. The second block accounted for 0.7% of the total variance, R^2=0.00, F(1, 7,217) =24.02, *p*<0.01. The third block accounted for 1.0% of the total variance, R^2=0.01, F(1, 7,216) =24.54, *p*<0.01. The final block including moderators accounted for 23.3% of the total variance, R^2=0.23, F(8, 7,208), =199.07, *p*<0.01. Alcohol cubic term was removed during the backward elimination.

In the backward elimination model, 23.3% of the variance was accounted for, R^2=0.23, F(10, 7,209), =218.61, *p*<0.01. The linear alcohol term was no longer of statistical significance within this model. However, alcohol quadratic term, age, ethnicity, disability, employment, expectancy, baseline depression, baseline anxiety, and WSAS were all of statistical significance. Therefore, the quadratic term for number of alcohol units consumed per week was significantly associated with post-treatment anxiety score after controlling for variables as shown in figure 2. The confidence interval is close to the line of best fit around low units of alcohol per week and less severe anxiety, indicating that this data is more robust, although as the units of alcohol increased there was a greater amount of variance (Appendix K).

Table 12

Hypothesis 3 - Post-treatment anxiety and alcohol use per week

	Block	*B*	SE	*p*	CI L	CI U
1	Alcohol units	-0.01	0.01	0.06	-0.03	0.00
	R^2	0.00				
2	Alcohol units	-0.09	0.01	0.00	-0.11	-0.06
	Alcohol quadratic	0.00	0.00	0.00	0.00	0.00
	R^2	0.01				
3	Alcohol units	-0.17	0.02	0.00	-0.22	-0.13
	Alcohol quadratic	0.01	0.00	0.00	0.00	0.01
	Alcohol cubic	0.00	0.00	0.00	0.00	0.00
	R^2	0.01				
4	Alcohol units	-0.05	0.02	0.01	-0.09	-0.01
	Alcohol quadratic	0.00	0.00	0.02	0.00	0.00
	Alcohol cubic	0.00	0.00	0.08	0.00	0.00
	Age	-0.03	0.00	0.00	-0.04	-0.02
	Ethnicity	0.73	0.21	0.00	0.32	1.14
	Disability	0.69	0.19	0.00	0.31	1.06
	Employment	1.96	0.16	0.00	1.64	2.28
	Expectancy	-0.17	0.03	0.00	-0.24	-0.10
	Baseline depression	0.16	0.01	0.00	0.13	0.19
	Baseline anxiety	0.31	0.02	0.00	0.27	0.34
	WSAS	0.05	0.01	0.00	0.03	0.06
	R^2	0.23				
Final model	Alcohol units	-0.02	0.01	0.08	-0.04	0.00
	Alcohol quadratic term	0.00	0.00	0.01	0.00	0.00
	Age	-0.03	0.00	0.00	-0.04	-0.02
	Ethnicity	0.74	0.21	0.00	0.33	1.16
	Disability	0.69	0.19	0.00	0.32	1.06
	Employment	1.97	0.16	0.00	1.65	2.29
	Expectancy	-0.17	0.03	0.00	-0.24	-0.10
	Baseline depression	0.16	0.01	0.00	0.13	0.19
	Baseline anxiety	0.31	0.02	0.00	0.27	0.34
	WSAS	0.05	0.01	0.00	0.03	0.06
	R^2	0.23				

Notes: B: Beta; SE: Standard Error; CI: Confidence interval; WSAS: Work and social adjustment scale

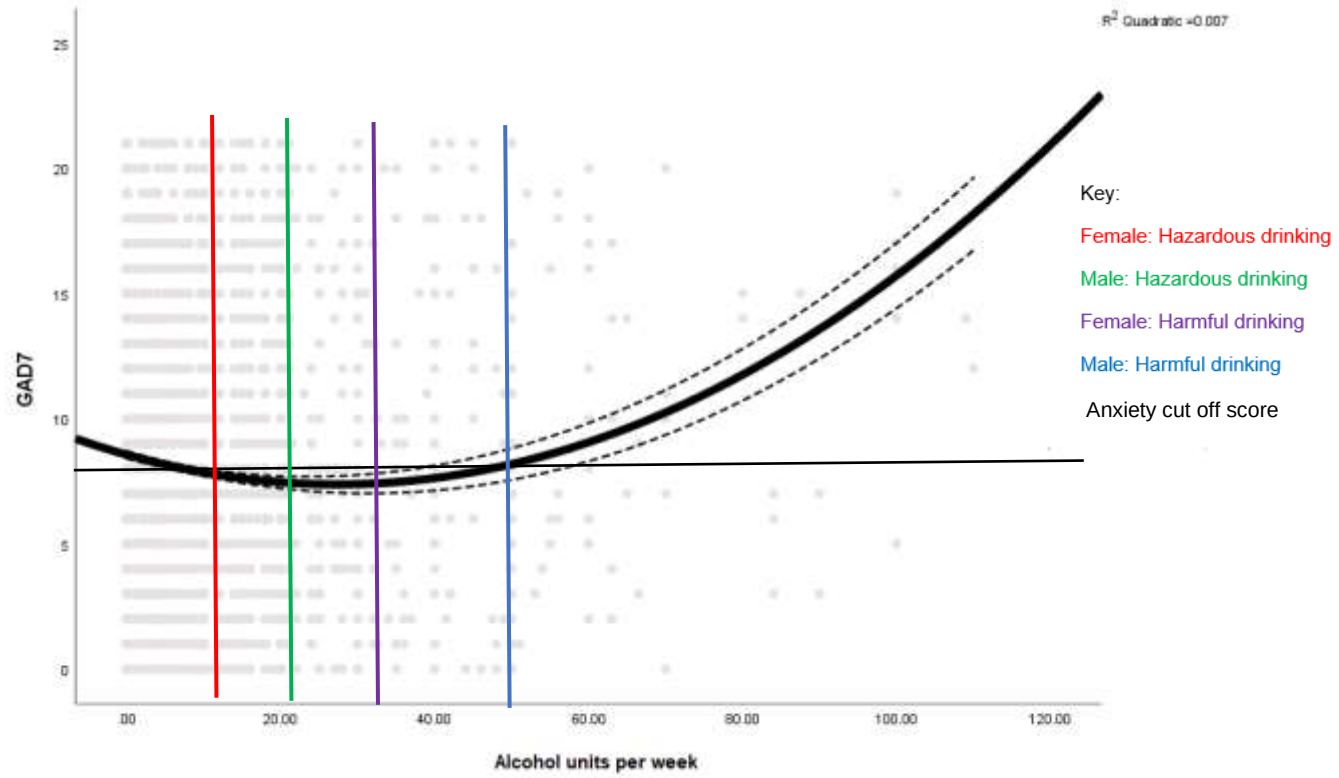

Figure 2. The quadratic association between post-treatment anxiety severity and *alcohol use per week*

Hypothesis 4

There will be a statistically significant association between the severity of dependence scale and baseline severity of depression and anxiety symptoms.

Depression

In the hierarchical regression model, as shown in table 13, the first block accounted for 5% of the total variance, R^2=0.05, F(1, 193) =10.15, p<0.01. The second block, including moderators accounted for 51.8% of the total variance, R^2=0.52, F(7, 186), =24.96, p<0.01. Baseline depression, age, disability, employment, expectancy, and ethnicity did not account for any of the variance within block 2 of the model. The association was accounted for by variables: baseline anxiety and WSAS.

Table 13

Hypothesis 4 - Baseline depression and SDS

	Block	*B*	SE	*p*	CI L	CI U
1	SDS	0.40	0.13	0.00	0.15	0.65
	R^2	0.05				
2	SDS	0.05	0.10	0.62	-0.14	0.24
	Age	0.02	0.03	0.54	-0.03	0.06
	Ethnicity	-0.59	1.24	0.64	-3.03	1.86
	Disability	-0.04	0.91	0.97	-1.82	1.75
	Employment	0.58	0.76	0.44	-0.91	2.07
	Expectancy	0.15	0.17	0.38	-0.19	0.49
	Baseline anxiety	0.54	0.07	0.00	0.40	0.68
	WSAS	0.28	0.04	0.00	0.20	0.35
	R^2	0.52				

Notes: B: Beta; SE: Standard Error; CI: Confidence interval;
WSAS: Work and social adjustment scale

Anxiety

In the hierarchical regression model, as shown in table 14, the first block accounted for 3.4% of the total variance, R^2=0.03, F(1, 193) =6.84, *p*=0.01. The second block, including moderators, accounted for 37.4% of the total variance, R^2=0.37, F(7, 186), =13.90, *p*<0.01. WSAS, age, disability, employment, expectancy, and ethnicity did not account for any of the variance within block 2 of the model. Baseline depression was statistically significant in block 2 of the model.

Table 14

Hypothesis 4 - Baseline anxiety and SDS

	Block	*B*	SE	*p*	CI L	CI U
1	SDS	0.26	0.10	0.01	0.06	0.46
	R^2	0.03				
2	SDS	0.08	0.09	0.35	-0.09	0.26
	Age	-0.02	0.02	0.45	-0.06	0.03
	Ethnicity	1.19	1.11	0.28	-0.99	3.38
	Disability	-0.14	0.81	0.87	-1.74	1.46
	Employment	0.72	0.68	0.29	-0.61	2.05
	Expectancy	-0.04	0.15	0.80	-0.34	0.26
	Baseline depression	0.43	0.06	0.00	0.32	0.55
	WSAS	0.02	0.04	0.63	-0.06	0.10
	R^2	0.37				

Notes: B: Beta; SE: Standard Error; CI: Confidence interval;
WSAS: Work and social adjustment scale

Hypothesis 5

There will be a statistically significant negative association between the severity of dependence scale and treatment attendance.

In the hierarchical regression model, as shown in table 15, the first block accounted for 1.7% of the total variance, R^2=0.02, F(1, 193) =3.31, *p*=0.07. The second block including moderators accounted for 5.1% of the total variance, R^2=0.05, F(8, 185), =1.10, *p*=0.37. None of the independent variables were of statistical significance. The association was accounted for by dependent variables.

Table 15

Hypothesis 5 – Contacts attended and SDS

	Block	*B*	SE	*p*	CI U	CI L
1	SDS	-0.26	0.14	0.07	-0.55	0.02
	R^2	0.02				
2	SDS	-0.29	0.16	0.06	-0.60	0.01
	Age	0.07	0.04	0.06	0.00	0.15
	Ethnicity	-0.63	1.98	0.75	-4.53	3.27
	Disability	-1.11	1.44	0.44	-3.96	1.74
	Employment	-1.07	1.21	0.38	-3.45	1.31
	Expectancy	-0.12	0.27	0.67	-0.66	0.42
	Baseline depression	0.02	0.12	0.87	-0.21	0.25
	Baseline anxiety	0.05	0.13	0.71	-0.21	0.31
	WSAS	-0.05	0.07	0.46	-0.19	0.09
	R^2	0.05				

Notes: B: Beta; SE: Standard Error; CI L: Confidence interval lower;
CI U: Confidence interval upper; WSAS: Work and social adjustment scale

Hypothesis 6

Linear associations between severity of dependence and post-treatment depression or anxiety symptoms will not be statistically significant.

Depression

In the hierarchical regression model, as shown in table 16, the first block accounted for 5.5% of the total variance, R^2=0.06, F(1, 181) =10.45, *p*=0.01. The second block including moderators accounted for 29.7% of the total variance, R^2=0.30, F(8, 173), =8.11, *p*<0.01. Only baseline depression and employment were of statistical significance and accounted for the variance.

Table 16

Hypothesis 6 - Post-treatment depression and SDS

	Block	*B*	SE	*p*	CI L	CI U
1	SDS	0.51	0.16	0.23	0.20	0.82
	R^2	0.55				
2	SDS	0.19	0.15	0.08	-0.11	0.48
	Age	0.00	0.04	0.00	-0.08	0.07
	Ethnicity	-1.15	1.92	-0.04	-4.93	2.64
	Disability	1.31	1.39	0.06	-1.43	4.06
	Employment	4.60	1.16	0.27	2.31	6.89
	Expectancy	0.34	0.27	0.08	-0.18	0.87
	Baseline depression	0.27	0.12	0.22	0.05	0.50
	Baseline anxiety	0.02	0.13	0.01	-0.23	0.27
	WSAS	0.13	0.07	0.15	-0.01	0.26
	R^2	0.30				

Notes: B: Beta; SE: Standard Error; CI L: Confidence interval lower; CI U: Confidence interval upper; WSAS: Work and social adjustment scale

Anxiety

In the hierarchical regression model, as shown in table 17, the first block accounted for 5% of the total variance, R^2=0.05, F(1, 182) =9.50, *p*=0.02. The second block including moderators accounted for 26% of the total variance, R^2=0.26, F(8, 174), =6.81, *p*<0.01. Only employment status was of statistical significance and accounted for the variance.

Table 17

Hypothesis 6 - Post-treatment anxiety and SDS

	Block	*B*	SE	*p*	CI L	CI U
1	SDS	0.40	0.13	0.00	0.15	0.66
	R^2	0.50				
2	SDS	0.16	0.13	0.22	-0.10	0.41
	Age	-0.01	0.03	0.76	-0.07	0.05
	Ethnicity	-2.89	1.63	0.08	-6.10	0.32
	Disability	1.66	1.18	0.16	-0.67	3.99
	Employment	3.34	0.99	0.00	1.40	5.29
	Expectancy	0.30	0.23	0.19	-0.15	0.74
	Baseline depression	0.11	0.10	0.29	-0.09	0.30
	Baseline anxiety	0.18	0.11	0.09	-0.03	0.40
	WSAS	0.10	0.06	0.10	-0.02	0.21
	R^2	0.26				

Notes: B: Beta; SE: Standard Error; CI L: Confidence interval lower; CI U: Confidence interval upper; WSAS: Work and social adjustment scale

Goodness of fit tests

Goodness of fit tests were calculated to view how well the model fits the data, whilst taking into account whether the model over-fits the data (Field, 2009). Three tests were calculated, AIC, BIC, and -2 log likelihood ratio test, as shown in table 18. The tests indicated the amount of information lost by using the model. The higher the quality of model the less information a model loses. The overall magnitude of the calculations was evaluated and when baseline anxiety was the dependent variable the model fitted the best, i.e. hypothesis 1, which was indicated across all three measures of fit. Therefore, alcohol level modelled as a non-linear factor was a better fit to the data.

Table 18

Goodness of fit tests

Target variable	AIC	BIC	-2 log likelihood ratio
Post-treatment depression	45935.01	45996.94	45916.98
Post-treatment anxiety	44478.65	44540.58	44460.62
Baseline depression	42335.67	42390.98	42319.65
Baseline anxiety	**40837.84**	**40893.14**	**40821.82**
Contacts attended	47158.59	47220.81	47140.57

Notes: AIC: Akaike information criterion; BIC: Bayesian information Criterion

Discussion

This study aimed to investigate the association between alcohol use and symptoms of common mental health problems, by inspecting linear and curvilinear associations. This was measured using scale data, which is a novel association within the literature and to provide useful clinical recommendations. Three hypotheses (H1-H3) were developed to investigate the number of alcohol units consumed per week and variables of anxiety severity, depression severity, and the number of contacts attended. A further three hypotheses (H4-H6) were developed to investigate the severity of dependence scale, and any association with anxiety score, depression score, and the number of contacts attended.

Hypothesis 1 was supported by the data for baseline depression score, indicating a cubic association when controlling for confounding variables (age, disability, employment, expectancy, baseline depression, baseline anxiety, and WSAS). Hazardous drinkers (14-50 units of alcohol per week) and participants who drink more than 90 units of alcohol a week, have a lower baseline depression score than participants who are non-harmful drinkers (<14 units of alcohol per week) and those with low levels of hazardous drinking (51-90 units of alcohol per week). This

appears to be an unusual finding, as many studies have reported a J shaped association between mental health and alcohol use (Alati et al., 2005; Guertler et al., 2020), and some theories would propose that a J shaped association suggests that participants within the moderate range of alcohol use and lower levels of depression are more adjusted to society's norms (Pape & Hammer, 1996). This theory does not take into account those participants who drank large quantities of alcohol and had lower levels of depression than those who drank within the low hazardous range. However, some of the research uses a measure of problems associated with drinking, rather than actual units of alcohol (Rodgers et al., 2000).

When investing the data for baseline anxiety, there was a significant association between the number of alcohol units per week and baseline anxiety, until the confounding variables were controlled. However, variables of age, expectancy, baseline PHQ-9, and WSAS were all significantly associated with baseline anxiety levels, accounting for 39.8% of the total variance. This finding supports previous evidence that alcohol use was not associated with treatment outcome (Buckman et al., 2018).

To explore hypothesis 2, the number of alcohol units consumed per week was not significantly associated with number of contacts attended. However, variables of employment, baseline anxiety and WSAS were all significantly associated with number of contacts attended, accounting for 0.7% of the total variance within the model. This supports the research by Buckman et al. (2018), that utilised the AUDIT-C to measure alcohol use within an IAPT sample.

When considering hypothesis 3, both post-treatment anxiety and depression scores are not significant as a linear association with alcohol use after controlling for variables. In the depression model, the regression coefficients for baseline anxiety, WSAS, age, disability, employment, ethnicity, and expectancy were all of statistical significance. Post-treatment anxiety revealed a significant quadratic association, for number of alcohol units consumed per week and post-treatment anxiety score after controlling for variables (age, ethnicity, disability, employment, expectancy, baseline depression, baseline anxiety, and WSAS). Therefore, people who drink moderately have lower post-treatment anxiety scores than people who drink at low levels or hazardous levels. This finding supports previous research into alcohol use and common mental health difficulties using a binary classification of anxiety (Skogen, Harvey, Henderson, Stordal, & Mykletun, 2009).

When investing the SDS data across hypotheses 4-6, severity was not associated with either baseline or post-treatment anxiety and depression. There was no association between the number of contacts attended and SDS after controlling for variables. This supported hypothesis 6. This study did not support the findings in Boschloo, Van den Brink, Penninx, Wall and Hasin's (2012) research, which indicated that the severity of an alcohol use disorder was associated with depression, when using the DSM criteria to define severity, rather than the SDS. There appears to be a lack of research using the SDS and associations with CMHP.

When considering moderators that account for variance within the regression models, certain moderators appear multiple times; for example the moderator that

most commonly accounts for variance with the samples are WSAS and employment status. Despite the moderators accounting for some of the variance within the sample, there is still unaccounted variance. Alati et al. (2005) found that confounders of low income and smoking status were moderators of the association between mental health and alcohol use; this analysis did not control these variables. However, this study takes into account the main variables found in a meta-analysis of variables that have been found to predict treatment outcome in alcohol interventions using a multivariate analysis (Adamson, Sellman, & Frampton, 2009).

Limitations

When considering the results of this research it is important to bear in mind some of the limitations within the study. The study benefited from a large sample size; however, this was limited to an outpatient primary care mental health service.

Participants were appropriately recruited into the research using a consecutive sample, however the total number of clients who declined to participate in the research was unknown. This may have been useful to compare the key characteristics across groups. When conducting a power analysis, it was recommended that a minimum sample size of 98 should be used, therefore the large sample size was a definite strength of the research.

To gather the data, various questionnaires were used as outcome measures such as the PHQ-9 and GAD-7. These questionnaires are validated for use on an adult population. It would have been useful to analyse the change indices on the scores

from baseline to post intervention, to assess whether any reliable and clinical change occurred alongside the observed association. All of the outcome measures are self-reported and can be subject to response bias and human error (Van de Mortal, 2008).

Despite accessing a large sample of participants, only *n*=195 participants completed the SDS for alcohol use. Within IAPT it was standard clinical policy that only participants who drank more than the recommended units of alcohol per week should be asked to complete the SDS. Therefore, this may skew the data, and participants who drink less than the recommended guidance are not represented. A further 10 participants had completed the SDS for drug use, however, this was not a variable that was controlled for within the study and may have accounted for some of the unexplained variance within the model. SDS was only measured once at baseline, and only for heavy drinkers. The SDS is a rarely used tool within research on alcohol use and common mental health problems, therefore there was a lack of pre-existing knowledge around how the severity of dependence of alcohol interacts with common mental health problems using a validated scale of severity.

When reviewing the literature there was a dearth of information on the exact number of alcohol units people consume with regard to their mental health. A lot of studies reduced the data variables to binary measures and therefore this has the potential to lose some of the more descriptive information, as when analyses took this into account, a cubic association for baseline depression and alcohol use was observed.

Within the results section, the regression models only accounted for some of the variance. However, caution has to be taken as the more variables that are included in the analysis can increase the chance of overlapping data (Glen, 2019).

Future research

When conducting this research there were some useful associations identified, however, there appears to be a lack of research using continuous measures of alcohol use and outcome measures. It is therefore important to continue to investigate this association and include further variables, for example drug use and smoking, to account for any of the unexplained variance within the regression model.

There appear to be multiple variables influencing the relationship between alcohol use and common mental health problems, therefore, it would be beneficial to explore how and why these associations impact on treatment outcome and a person's quality of life, to give personal meaning to the research in a qualitative exploration.

To explore the clinical relevance of the data, data could be re-analysed to investigate any reliable and clinical statistical change on the GAD-7 and PHQ-9, such as interpreting caseness and any association with alcohol use.

Research into the SDS and alcohol use was limited in the wider literature, therefore it would be beneficial to explore the severity of dependence association with alcohol use using all the data, rather than only data from those who drink to excess.

This could also be developed further to include an investigation of the SDS at different levels of alcohol use, such as alcohol dependency or severe dependency.

Most clients are referred to IAPT when their mental health problem is perceived as the primary difficulty. However, it would be useful to investigate this association using a service for substance use and compare any associations or clinical implications.

Clinical implications

Clinicians often perceive that people who are heavy drinkers alongside experiencing depression or anxiety have poorer treatment outcomes. This research suggested that alcohol use was not associated with baseline anxiety, post-treatment depression, or the number of contacts attended. Clinicians may perceive alcohol use to impact treatment outcomes as the relationship is heavily moderated by other variables, which clinicians may be unaware of, and it is hard to account for all the variance within the relationship. Also, some of the moderators are protected characteristics under the equality act (HM Government, 2010), and therefore, it would be deemed unethical to have a service exclusion criterion based on age, ethnicity, or self-reported disability, despite these variables influencing the treatment outcome.

When a client attends a service such as IAPT, the only significant variable of note to a clinician would be that people with either low alcohol use or low hazardous use may have more symptoms of depression than those who drink moderately or extremely hazardously. This relationship was influenced by the other demographic

characteristics studied (excluding ethnicity). Therefore, it is important to consider this within the assessment process. Post-treatment anxiety scores were found to be associated with alcohol use, whereby participants who drink moderately had lower levels of anxiety after treatment compared to those who drink alcohol at either low or hazardous levels. Again, this relationship was moderated by all the independent variables, suggesting that it is not just alcohol use that is associated with the outcome of therapy. This would therefore, suggest that alcohol use should not be used as an exclusion criterion, as this relationship alone only accounts for a very small proportion of the variance. All the variables; age, disability status, expectancy, baseline anxiety, baseline depression, ethnicity, and WSAS, can be incorporated into the intervention using a holistic, person centred approach.

When examining the self-reported SDS, no association was found between treatment outcome and total contacts attended. This would suggest the severity of dependence is something that could be considered in relation to how this impacts the individual and their ability to achieve their goals. However, there is no evidence to suggest that it should be used as a standalone exclusion criteria from a service. All clients, regardless of severity of alcohol use, could be given the choice of whether they would prefer to access either a mental health service or substance use service.

Conclusion

This study adds to the evidence base for the association of alcohol use and treatment outcome using continuous measures. A significant curvilinear relationship was found between alcohol use and baseline depression and post-treatment anxiety

scores, however the variance within these relationships was partially accounted for by a variety of different variables. It is important that mental health services consider this before choosing to exclude clients on the sole basis of their alcohol use, and consider providing an integrated assessment and treatment approach.

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Appendices

Appendix A – Anonymised Information leaflet

INFORMATION ABOUT STORING AND SHARING

YOUR CONFIDENTIAL INFORMATION

[Leaflet provided to all patients as soon as they are referred to the service

and before any treatment commences]

This leaflet gives details about the information we need to ensure that we provide you with a high quality service. It explains what happens to the information you provide and how you will be involved in sharing it. This leaflet gives you answers to commonly asked questions about how we store your confidential information, your right to access this information and our usual NHS practice of confidentiality.

If you have questions or concerns you can telephone us during office hours on the same number you used to make an appointment. It is important to us that you are happy with the arrangements we have made for your care, so please feel comfortable calling us if you are unsure. If after speaking with us you are still not happy you can contact PALS on 0800 0525790 who will be able to help you further.

What kind of information do you keep?

We keep contact information for you and others involved in your care, information about your background, assessments, results of tests and questionnaires, our plans for your future care, details of the care we give you and correspondence related to your care. It is important that you tell us within one week if you change your details, telephone numbers or address because we will continue to use the address and telephone numbers you have given us until you tell us they have changed.

How do you store information about my care?

We keep information about your care in paper records and on a specialist and secure computer system.

What are each of these used for?

The paper records contain notes and copies of documents related to your care. Our computer systems contain electronic records of your care. These systems are used by staff to plan and monitor the quality

of your care, to conduct audit and research in order to continually improve the quality of the services that we offer, and to plan future services.

Can I see my records?

Yes, we are happy to provide you with a copy of your records and you will need to write to us to request these (there may be a standard copying fee) or if appropriate we can meet with you to read and discuss your notes together.

Who will know about my care?

You have control over who else is involved in your care and this service observes strict NHS standards of confidentiality. The only time we will inform others without your permission is if we are very concerned for your immediate safety, for the safety of someone else, or if a British Court orders the release of your records. We will try to contact you first if this happens and do our best to help you.

We work in partnership with three voluntary sector organisations in ***, 1, 2, and 3. After discussing with you, you may be offered an appointment with one of these organisations and with your permission information will be shared. All organisations adhere to strict NHS standards of confidentiality.

We will write to your GP about your care; this is usual in the NHS as your GP is the main person who organises your care.

How does the service use the questionnaires and other information to improve my care?

After you have completed the questionnaires we enter your results into our secure computer system. We use the results to plan your care. You can ask for a print out of your results from your therapist to show how much you have improved.

How is the information used to improve the service offered?

After we have removed all your details from the results, we collect together all the results from all the patients. This means that someone who looks at the data cannot tell who gave the replies (the data is anonymous) and it is impossible to identify any individual patient. We use these results to look for ways to improve the service we offer through audit and research. We also provide this anonymous data to organisations that pay for the service we offer and share what we have learned with other health professionals. If you wish to find out further details about how anonymous information is used in audit, research and reporting, or if you wish to withdraw your consent to share your information for these purposes, please contact us on the number provided on the front page of this leaflet.

How can I help?

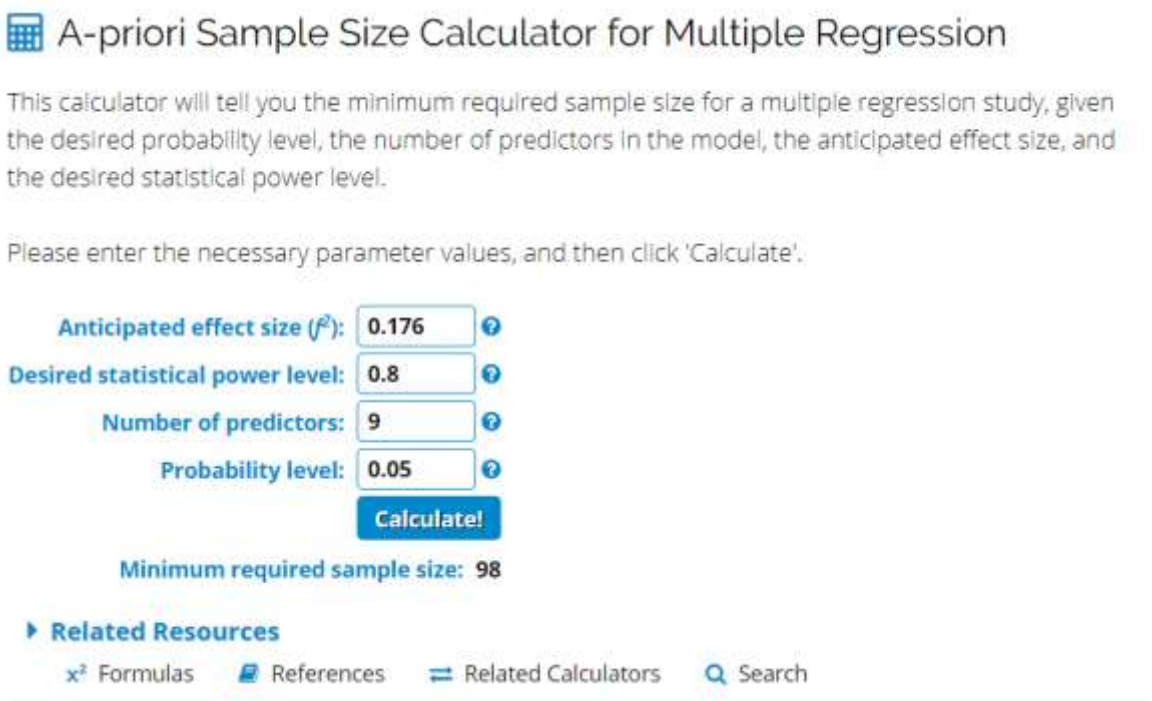
As part of your treatment you will be asked to complete some questionnaires. These questionnaires are not compulsory; however, they are an important part of your treatment and we use them to tailor your care to your individual needs. In addition, without these results it is more difficult to assess your improvement and we cannot show how we are helping people.

If you have further questions please ask to speak with a member of the team:

Primary Care Mental Health Service

Address: **Tel:**

Appendix B – Sample size calculation



Appendix C – PHQ-9

PATIENT HEALTH QUESTIONNAIRE-9 (PHQ-9)

Over the last 2 weeks, how often have you been bothered by any of the following problems? *(Use "✔" to indicate your answer)*	**Not at all**	**Several days**	**More than half the days**	**Nearly every day**
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself — or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed? Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead or of hurting yourself in some way	0	1	2	3

FOR OFFICE CODING 0 + _____ + _____ + _____

=Total Score: _____

If you checked off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?

Not difficult at all	**Somewhat difficult**	**Very difficult**	**Extremely difficult**
☐	☐	☐	☐

Appendix D – GAD-7

Generalized Anxiety Disorder 7-item (GAD-7) scale

Over the last 2 weeks, how often have you been bothered by the following problems?	Not at all sure	Several days	Over half the days	Nearly every day
1. Feeling nervous, anxious, or on edge	0	1	2	3
2. Not being able to stop or control worrying	0	1	2	3
3. Worrying too much about different things	0	1	2	3
4. Trouble relaxing	0	1	2	3
5. Being so restless that it's hard to sit still	0	1	2	3
6. Becoming easily annoyed or irritable	0	1	2	3
7. Feeling afraid as if something awful might happen	0	1	2	3
Add the score for each column	+	+	+	
Total Score *(add your column scores)* =				

If you checked off any problems, how difficult have these made it for you to do your work, take care of things at home, or get along with other people?

Not difficult at all _____
Somewhat difficult _____
Very difficult _____
Extremely difficult _____

Source: Spitzer RL, Kroenke K, Williams JBW, Lowe B. A brief measure for assessing generalized anxiety disorder. *Arch Inern Med.* 2006;166:1092-1097.

Appendix E – Alcohol Screening

Do you drink alcohol? Yes/No
Average alcohol units per week (in the last month) _____

Appendix F – Severity of Dependence Scale

Measure omitted

Appendix G – Outcome Expectancy Measure

If the service were to offer you some psychological therapy, at this point in time how confident are you that this kind of treatment will work for you on a scale of 0 (not at all) to 10 (definitely)? _____

Appendix H – Work and Social Adjustment Scale

Work and Social Adjustment Scale (WSAS)

Identifier _____ Date _____

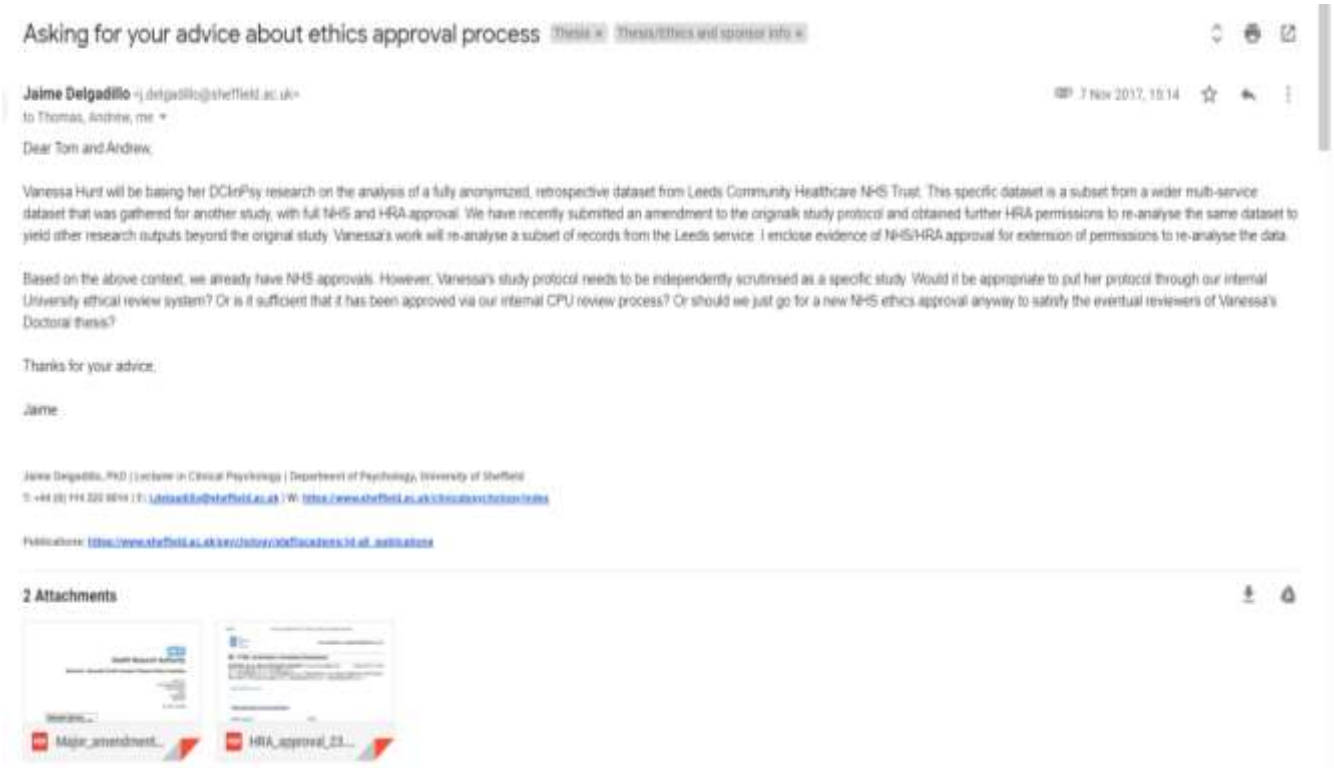
People's problems sometimes affect their ability to do certain day-to-day tasks in their lives. To rate your problems look at each section and determine on the scale provided how much your problem impairs your ability to carry out the activity. This assessment is not intended to be a diagnosis. If you are concerned about your results in any way, please speak with a qualified health professional.

If you're retired or choose not to have a job for reasons unrelated to your problem, tick here ☐

	0 Not at all	1	2 Slightly	3	4 Definitely	5	6 Markedly	7	8 Very severely
1	Because of my [problem] my **ability to work** is impaired. '0' means 'not at all impaired' and '8' means very severely impaired to the point I can't work.								
2	Because of my [problem] my **home management** (cleaning, tidying, shopping, cooking, looking after home or children, paying bills) is impaired.								
3	Because of my [problem] my **social leisure activities** (with other people e.g. parties, bars, clubs, outings, visits, dating, home entertaining) are impaired.								
4	Because of my [problem], my **private leisure activities** (done alone, such as reading, gardening, collecting, sewing, walking alone) are impaired.								
5	Because of my [problem], my ability to form and maintain **close relationships** with others, including those I live with, is impaired.								

Print Form Clear Form Total WSAS score = _____

Appendix I – Ethical Approval



Asking for your advice about ethics approval process Thesis × Thesis/ethics and sponsor info ×

Jaime Delgadillo <j.delgadillo@sheffield.ac.uk>
to Thomas, Andrew, me ▾

7 Nov 2017, 10:14

Dear Tom and Andrew,

Vanessa Hunt will be basing her DClinPsy research on the analysis of a fully anonymized, retrospective dataset from Leeds Community Healthcare NHS Trust. This specific dataset is a subset from a wider multi-service dataset that was gathered for another study, with full NHS and HRA approval. We have recently submitted an amendment to the originalk study protocol and obtained further HRA permissions to re-analyse the same dataset to yield other research outputs beyond the original study. Vanessa's work will re-analyse a subset of records from the Leeds service. I enclose evidence of NHS/HRA approval for extension of permissions to re-analyse the data.

Based on the above context, we already have NHS approvals. However, Vanessa's study protocol needs to be independently scrutinised as a specific study. Would it be appropriate to put her protocol through our internal University ethical review system? Or is it sufficient that it has been approved via our internal CPU review process? Or should we just go for a new NHS ethics approval anyway to satisfy the eventual reviewers of Vanessa's Doctoral thesis?

Thanks for your advice,

Jaime

Jaime Delgadillo, PhD | Lecturer in Clinical Psychology | Department of Psychology, University of Sheffield
T: +44 (0) 114 222 6514 | E: j.delgadillo@sheffield.ac.uk | W: https://www.sheffield.ac.uk/clinicalpsychology/index

Publications: https://www.sheffield.ac.uk/psy/about/staffacademic/jd-all_publications

2 Attachments

Major_amendment...

HRA_approval_23...

Jaime Delgadillo <j.delgadillo@sheffield.ac.uk>

RE: 171802. Confirmation of Amedment Assessment

HANSFORD, Nuviya (HEALTH RESEARCH AUTHORITY) <nuviya.hansford@nhs.net> 23 March 2017 at 14:50
To: "m.lucock@hud.ac.uk" <m.lucock@hud.ac.uk>
Cc: "r.a.armitage@hud.ac.uk" <r.a.armitage@hud.ac.uk>, "DOBRZANSKA, Linda (LEEDS COMMUNITY HEALTHCARE NHS TRUST)" <linda.dobrzanska@nhs.net>, "j.delgadillo@sheffield.ac.uk" <j.delgadillo@sheffield.ac.uk>

Dear Professor Lucock,

-

Please quote these on all correspondence

IRAS Project ID:	**171802**
Amendment No./ Sponsor Ref:	**Substantial Amendment 1 - 24/1/17**
Amendment Date:	**24 January 2017**

Further to the below, I am pleased to confirm that HRA Approval has been issued for the referenced amendment, following assessment against the HRA criteria and standards.

The sponsor should now work collaboratively with participating NHS organisations in England to implement the amendment as per the below categorisation information. This email may be provided by the sponsor to participating organisations in England to evidence that the amendment has HRA Approval.

Please contact hra.amendments@nhs.net for any queries relating to the assessment of this amendment.

Yours sincerely,

Nuviya

Nuviya Hansford
Health Research Authority

3rd Floor, Barlow House, 4 Minshull Street,

Manchester, M1 3DZ

Your centre's telephone 0207 104 8063 | www.hra.nhs.uk
E: hra.approval@nhs.net

From: nrescommittee.northeast-newcastleandnorthtyneside2@nhs.net [mailto:nrescommittee.northeast-newcastleandnorthtyneside2@nhs.net]
Sent: 23 February 2017 14:00
To: m.lucock@hud.ac.uk
Cc: r.a.armitage@hud.ac.uk; linda.dobrzanska@nhs.net; j.delgadillo@sheffield.ac.uk
Subject: IRAS 171802. Confirmation of REC Validation and Categorisation of Amendment

Dear Professor Lucock,

IRAS Project ID:	**171802**
REC Reference:	**15/NE/0062**
Short Study Title:	**Stress Control Study**
Date complete amendment submission received:	**23 February 2017**
Amendment No./ Sponsor Ref:	**Substantial Amendment 1 - 24/1/17**
Amendment Date:	**24 January 2017**
Amendment Type:	**Substantial**

Thank you for submitting the above referenced amendment. I am pleased to confirm that this amendment has been submitted to the REC for ethical review. Please find attached a copy of the validation letter.

Categorisation of Amendment

In line with the UK Process for Handling UK Study Amendments I can confirm that this amendment has been categorised as:

- **Category A** - An amendment that has implications for, or affects, ALL participating NHS organisations

You should now provide this email, together with the amended documentation, to the research management support offices **and** local research teams at your participating NHS organisations in England.

If you have participating NHS organisations in Northern Ireland, Scotland and/or Wales, you should communicate directly with the relevant research teams to prepare them for implementing the amendment, as per the instructions below. You do not need to provide this email or your amended documentation to their research management support offices, as we will pass these to the relevant national coordinating functions who will do this on your behalf.

Subject to the three conditions below, you will be able to implement the amendment at your participating NHS organisations in England **35 days after you notify them of the amendment.** A template email to notify participating NHS organisations in England is provided here.

- You may not implement this amendment until and unless you receive all required regulatory approvals, including REC favourable opinion, (for participating organisations in England, this includes receiving confirmation of HRA Approval for the amendment). You should provide regulatory approvals to the research management support offices and local research teams at your

participating NHS organisations in England, plus to local research teams at any participating NHS organisations in Northern Ireland, Scotland or Wales*.

- You may not implement this amendment at any participating NHS organisations which inform you within the 35 day period that they require additional time to consider the amendment, until they notify you that the considerations have been satisfactorily completed.
- You may not implement this amendment at any participating NHS organisation that informs you that it is no longer able to undertake this study.

Note: you may only implement changes described in the amendment notice or letter.

If you receive required regulatory approvals (for participating organisations in England, this includes confirmation that the amendment has been granted HRA Approval) after the 35 days have passed, you may then immediately implement this amendment at all participating NHS organisations that have not requested additional review time, or are no longer able to undertake this study.

There is no need for you to receive a letter of confirmation from the participating organisation that the amendment can be implemented, as the intended date of implementation is communicated through the above process. However, you may be able to implement this amendment ahead of the 35 day deadline, if all necessary regulatory approvals are in place and the participating organisation has confirmed that the amendment may be implemented ahead of the 35 day date.

* Where the study involves NHS organisations in Northern Ireland, Scotland or Wales, the HRA will forward regulatory approvals to the relevant national coordinating function to distribute to their research management support offices.

Please do not hesitate to contact me if you require further information.

Kind regards

Kerry

Miss Kerry Dunbar | Research Ethics Committee Assistant
NNT2 Committee

Health Research Authority
Room 001, Jarrow Business Centre, Rolling Mill Road, Jarrow, Tyne & Wear, NE32 3DT
E: nrescommittee.northeast-newcastleandnorthtyneside2@nhs.net | T: 0207 104 8082

HRA Jarrow T: 0207 104 8118

HRA: 020 797 22545 | www.hra.nhs.uk

Would you like to receive the latest updates on HRA work? Sign up here

For more information on the HRA Approval process Click here

NHS
Health Research Authority

North East - Newcastle & North Tyneside 2 Research Ethics Committee

Room 001
Jarrow Business Centre
Rolling Mill Road
Jarrow
Tyne & Wear
NE32 3DT

Tel: 0207 104 8282

Please note: This is the favourable opinion of the REC only and does not allow the amendment to be implemented at NHS sites in England until the outcome of the HRA assessment has been confirmed.

17 March 2017

Professor Mike Lucock
Professor of Clinical Psychology
University of Huddersfield
School of Human and Health Sciences
University of Huddersfield
Queensgate
HD1 3DH

Dear Professor Lucock

Study title:	**Improving the effectiveness and efficiency of Stress Control classes within IAPT services in South and West Yorkshire**
REC reference:	**15/NE/0062**
Amendment number:	**Substantial Amendment 1 - 24/1/17**
Amendment date:	**24 January 2017**
IRAS project ID:	**171802**

The above amendment was reviewed by the Sub-Committee in correspondence.

This amendment is to gain approval for the proposed extension to the analysis using the same data resource.

Ethical opinion

The members of the Committee taking part in the review gave a favourable ethical opinion of the amendment on the basis described in the notice of amendment form and supporting documentation.

Members requested confirmation that the proposed analyses in Part 4 of the protocol have been verified by an independent statistician and that relevant and robust results can be obtained from the dataset.

Ms Jaime Delgadillo replied that yes, as described in the original IRAS REC application form, the study protocol (original and revised versions) had been independently assessed by David Saxon, statistician at the School of Health and Related Research, University of Sheffield.

Members requested confirmation that the providers of the data have given permission for the extension of the study in accordance with the IG section of the protocol.

Ms Jaime Delgadillo replied that the collaborating NHS Trusts had approved the extension of data analyses, and they would link in with each NHS Trust again after the approval of the proposed amendment to re-confirm permissions and to update their internal records for the study.

The Sub Committee was satisfied with the responses given to the issues raised.

Approved documents

The documents reviewed and approved at the meeting were:

Document	*Version*	*Date*
Covering letter on headed paper	Email from Jaime Delgadillo	22 February 2017
Notice of Substantial Amendment (non-CTIMP)	Substantial Amendment 1 - 24/1/17	24 January 2017
Research protocol or project proposal	Version 4	24 January 2017

Membership of the Committee

The members of the Committee who took part in the review are listed on the attached sheet.

Working with NHS Care Organisations

Sponsors should ensure that they notify the R&D office for the relevant NHS care organisation of this amendment in line with the terms detailed in the categorisation email issued by the lead nation for the study.

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

We are pleased to welcome researchers and R & D staff at our Research Ethics Committee members' training days – see details at http://www.hra.nhs.uk/hra-training/

15/NE/0062:	**Please quote this number on all correspondence**

Yours sincerely

pp

Mr Richard Tomlin
Chair

E-mail: nrescommittee.northeast-newcastleandnorthtyneside2@nhs.net

Enclosures: *List of names and professions of members who took part in the review*

Copy to: *Ms Linda Dobrzanska, Leeds Community Healthcare NHS Trust*
Professor Rachel Armitage, University of Huddersfield

North East - Newcastle & North Tyneside 2 Research Ethics Committee

Attendance at Sub-Committee of the REC meeting on 10 March 2017 via correspondence.

Committee Members:

Name	*Profession*	*Present*	*Notes*
Mrs Ann Boardman	Retired Educationalist	Yes	
Mr Richard Tomlin (Chair)	Consultant in Research Management (Retired)	Yes	

Also in attendance:

Name	*Position (or reason for attending)*
Miss Kerry Dunbar	REC Assistant

Appendix J – Confirmation of Scientific Approval and Indemnity

The University Of Sheffield.

Department Of Psychology.
Clinical Psychology Unit.

Doctor of Clinical Psychology (DClin Psy) Programme
Clinical supervision training and NHS research training & consultancy.

Clinical Psychology Unit
Department of Psychology
University of Sheffield
Floor F, Cathedral Court
1 Vicar Lane
Sheffield
S1 2LT

Dr A R Thompson, Clinical Training Research Director
Please address any correspondence to Amrit Sinha
Research Support Officer
Telephone: 0114 2226650
Email: a.sinha@sheffield.ac.uk

22nd January 2018

To: Research Governance Office

Dear Sir/Madam,

RE: Confirmation of Scientific Approval and indemnity of enclosed Research Project

Project title: ·Title of your project: Association between alcohol use, depression and anxiety outcomes in a psychological therapy service.

Investigators: Vanessa Hunt (DClin Psy Trainee, University of Sheffield); Jaime Delgadillo (Academic Supervisor, University of Sheffield).

I write to confirm that the enclosed proposal forms part of the educational requirements for the Doctoral Clinical Psychology Qualification (DClin Psy) run by the Clinical Psychology Unit, University of Sheffield.

Three independent scientific reviewers usually drawn from academic staff within the Psychology Department have reviewed the proposal. Review includes appraisal of the proposed statistical analysis conducted by a statistical expert based in the School of Health and Related Research

(ScHARR). Where appropriate an expert in qualitative methods is also appointed to review proposals.

I can confirm that approval of a proposal is dependent upon all necessary amendments having been made to the satisfaction of the reviewers and I can confirm that in this case the reviewers are content that the above study is of sound scientific quality. Consequently, the University will if necessary indemnify the study and act as sponsor.

Given the above, I would remind you that the Department already has an agreement with your office to exempt this proposal from further scientific review. However, if you require any further information, please do not hesitate to contact me.

Yours sincerely

Dr. Andrew Thompson

Director of Research Training

Cc. :, Vanessa Hunt, Jaime Delgadillo

Appendix K– SPSS Outputs for significant associations

Hypothesis 1 – Baseline depression and alcohol use

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	151.704	1	151.704	4.138	.042[b]
	Residual	273038.685	7448	36.659		
	Total	273190.389	7449			
2	Regression	2389.234	2	1194.617	32.852	.000[c]
	Residual	270801.155	7447	36.364		
	Total	273190.389	7449			
3	Regression	4473.927	3	1491.309	41.323	.000[d]
	Residual	268716.462	7446	36.089		
	Total	273190.389	7449			
4	Regression	146236.984	10	14623.698	856.895	.000[e]
	Residual	126953.405	7439	17.066		
	Total	273190.389	7449			

a. Dependent Variable: PHQ9_first

b. Predictors: (Constant), Alcohol_u_wk

c. Predictors: (Constant), Alcohol_u_wk, Alcohol_u_wk_quadratic

d. Predictors: (Constant), Alcohol_u_wk, Alcohol_u_wk_quadratic, Alcohol_u_wk_cubic

e. Predictors: (Constant), Alcohol_u_wk, Alcohol_u_wk_quadratic, Alcohol_u_wk_cubic, Expectancy, Age, GAD7_first, Ethnicity_binary, Unemployed_first, Disability_binary, WSAS_first

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	15.199	.079		191.441	.000	15.043	15.355
	Alcohol_u_wk	-.014	.007	-.024	-2.034	.042	-.028	-.001
2	(Constant)	15.418	.084		183.844	.000	15.254	15.583
	Alcohol_u_wk	-.100	.013	-.165	-7.708	.000	-.125	-.074
	Alcohol_u_wk_quadratic	.002	.000	.168	7.844	.000	.001	.002
3	(Constant)	15.588	.086		180.264	.000	15.418	15.757
	Alcohol_u_wk	-.231	.022	-.382	-10.719	.000	-.273	-.189
	Alcohol_u_wk_quadratic	.008	.001	.777	9.369	.000	.007	.010
	Alcohol_u_wk_cubic	-6.010E-5	.000	-.451	-7.600	.000	.000	.000
4	(Constant)	2.194	.290		7.559	.000	1.625	2.763
	Alcohol_u_wk	-.059	.015	-.098	-3.953	.000	-.089	-.030
	Alcohol_u_wk_quadratic	.003	.001	.248	4.320	.000	.001	.004
	Alcohol_u_wk_cubic	-2.019E-5	.000	-.151	-3.694	.000	.000	.000
	Age	.019	.004	.044	5.467	.000	.012	.026
	Ethnicity_binary	.254	.163	.012	1.556	.120	-.066	.574
	Disability_binary	.712	.147	.040	4.839	.000	.423	1.000
	Unemployed_first	.848	.125	.056	6.762	.000	.602	1.093
	Expectancy	-.109	.027	-.033	-4.090	.000	-.161	-.057
	GAD7_first	.557	.011	.443	50.406	.000	.536	.579
	WSAS_first	.262	.006	.388	43.185	.000	.250	.273

a. Dependent Variable: PHQ9_first

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.024[a]	.001	.000	6.055	.001	4.138	1	7448	.042
2	.094[b]	.009	.008	6.030	.008	61.532	1	7447	.000
3	.128[c]	.016	.016	6.007	.008	57.766	1	7446	.000
4	.732[d]	.535	.535	4.131	.519	1186.684	7	7439	.000

a. Predictors: (Constant), Alcohol_u_wk

b. Predictors: (Constant), Alcohol_u_wk, Alcohol_u_wk_quadratic

c. Predictors: (Constant), Alcohol_u_wk, Alcohol_u_wk_quadratic, Alcohol_u_wk_cubic

d. Predictors: (Constant), Alcohol_u_wk, Alcohol_u_wk_quadratic, Alcohol_u_wk_cubic, Expectancy, Age, GAD7_first, Ethnicity_binary, Unemployed_first, Disability_binary, WSAS_first

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.732[a]	.535	.535	4.131	.535	951.654	9	7440	.000

a. Predictors: (Constant), Alcohol_u_wk_cubic, Unemployed_first, Age, Expectancy, GAD7_first, Disability_binary, WSAS_first, Alcohol_u_wk, Alcohol_u_wk_quadratic

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	146195.660	9	16243.962	951.654	.000[b]
	Residual	126994.729	7440	17.069		
	Total	273190.389	7449			

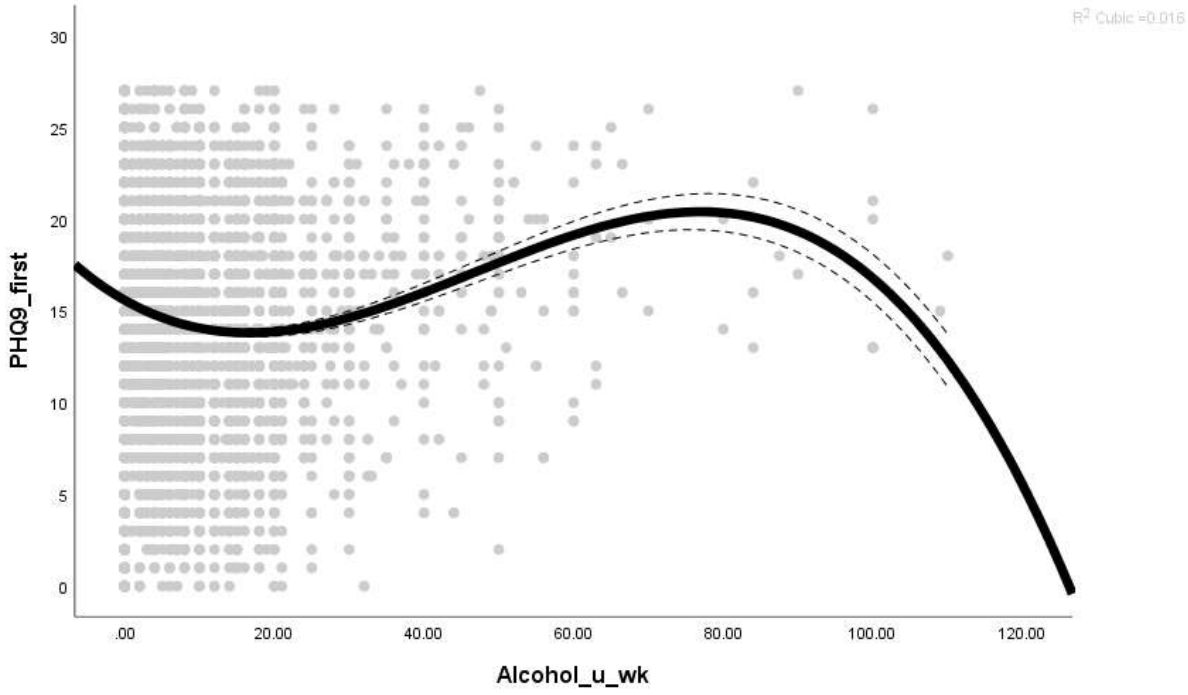
a. Dependent Variable: PHQ9_first

b. Predictors: (Constant), Alcohol_u_wk_cubic, Unemployed_first, Age, Expectancy, GAD7_first, Disability_binary, WSAS_first, Alcohol_u_wk, Alcohol_u_wk_quadratic

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	2.223	.290		7.674	.000	1.655	2.791
	Age	.019	.004	.044	5.390	.000	.012	.026
	Disability_binary	.708	.147	.040	4.811	.000	.419	.996
	Unemployed_first	.853	.125	.057	6.810	.000	.608	1.099
	Expectancy	-.109	.027	-.032	-4.082	.000	-.161	-.057
	GAD7_first	.558	.011	.443	50.410	.000	.536	.579
	WSAS_first	.262	.006	.388	43.299	.000	.250	.274
	Alcohol_u_wk	-.061	.015	-.101	-4.076	.000	-.090	-.032
	Alcohol_u_wk_quadratic	.003	.001	.252	4.388	.000	.002	.004
	Alcohol_u_wk_cubic	-2.044E-5	.000	-.153	-3.742	.000	.000	.000

a. Dependent Variable: PHQ9_first



Hypothesis 3 – Post-treatment anxiety and alcohol use

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Alcohol_u_wk[b]	.	Enter
2	Alcohol_u_wk_quadratic[b]	.	Enter
3	Alcohol_u_wk_cubic[b]	.	Enter
4	Expectancy, Age, GAD7_first, Ethnicity_binary, Unemployed_first, Disability_binary, WSAS_first, PHQ9_first[b]	.	Enter

a. Dependent Variable: GAD7_last

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.022[a]	.000	.000	5.986	.000	3.414	1	7218	.065
2	.081[b]	.007	.006	5.968	.006	44.606	1	7217	.000
3	.100[c]	.010	.010	5.958	.003	25.405	1	7216	.000
4	.483[d]	.233	.232	5.248	.223	261.865	8	7208	.000

a. Predictors: (Constant), Alcohol_u_wk

b. Predictors: (Constant), Alcohol_u_wk, Alcohol_u_wk_quadratic

c. Predictors: (Constant), Alcohol_u_wk, Alcohol_u_wk_quadratic, Alcohol_u_wk_cubic

d. Predictors: (Constant), Alcohol_u_wk, Alcohol_u_wk_quadratic, Alcohol_u_wk_cubic, Expectancy, Age, GAD7_first, Ethnicity_binary, Unemployed_first, Disability_binary, WSAS_first, PHQ9_first

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	122.335	1	122.335	3.414	.065[b]
	Residual	258662.664	7218	35.836		
	Total	258784.999	7219			
2	Regression	1711.224	2	855.612	24.020	.000[c]
	Residual	257073.775	7217	35.621		
	Total	258784.999	7219			
3	Regression	2613.119	3	871.040	24.536	.000[d]
	Residual	256171.881	7216	35.501		
	Total	258784.999	7219			
4	Regression	60300.347	11	5481.850	199.074	.000[e]
	Residual	198484.652	7208	27.537		
	Total	258784.999	7219			

a. Dependent Variable: GAD7_last

b. Predictors: (Constant), Alcohol_u_wk

c. Predictors: (Constant), Alcohol_u_wk, Alcohol_u_wk_quadratic

d. Predictors: (Constant), Alcohol_u_wk, Alcohol_u_wk_quadratic, Alcohol_u_wk_cubic

e. Predictors: (Constant), Alcohol_u_wk, Alcohol_u_wk_quadratic, Alcohol_u_wk_cubic, Expectancy, Age, GAD7_first, Ethnicity_binary, Unemployed_first, Disability_binary, WSAS_first, PHQ9_first

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	8.370	.080		104.887	.000	8.213	8.526
	Alcohol_u_wk	-.013	.007	-.022	-1.848	.065	-.027	.001
2	(Constant)	8.557	.084		101.418	.000	8.392	8.723
	Alcohol_u_wk	-.086	.013	-.145	-6.628	.000	-.112	-.061
	Alcohol_u_wk_quadratic	.002	.000	.146	6.679	.000	.001	.002
3	(Constant)	8.670	.087		99.481	.000	8.499	8.841
	Alcohol_u_wk	-.174	.022	-.291	-8.018	.000	-.216	-.131
	Alcohol_u_wk_quadratic	.006	.001	.553	6.609	.000	.004	.008
	Alcohol_u_wk_cubic	-4.035E-5	.000	-.300	-5.040	.000	.000	.000
4	(Constant)	2.701	.377		7.159	.000	1.961	3.440
	Alcohol_u_wk	-.048	.019	-.080	-2.452	.014	-.086	-.010
	Alcohol_u_wk_quadratic	.002	.001	.176	2.361	.018	.000	.003
	Alcohol_u_wk_cubic	-1.240E-5	.000	-.092	-1.748	.081	.000	.000
	GAD7_first	.306	.017	.246	18.517	.000	.274	.338
	PHQ9_first	.159	.015	.161	10.631	.000	.130	.189
	WSAS_first	.046	.009	.068	5.181	.000	.028	.063
	Age	-.030	.005	-.069	-6.482	.000	-.039	-.021
	Disability_binary	.686	.191	.039	3.600	.000	.312	1.060
	Unemployed_first	1.959	.163	.131	12.039	.000	1.640	2.278
	Expectancy	-.172	.035	-.052	-4.959	.000	-.240	-.104
	Ethnicity_binary	.731	.211	.036	3.460	.001	.317	1.145

a. Dependent Variable: GAD7_last

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	WSAS_first, Alcohol_u_wk_quadratic, Age, Expectancy, Ethnicity_binary, Disability_binary, Unemployed_first, GAD7_first, PHQ9_first, Alcohol_u_wk[b]	.	Enter

a. Dependent Variable: GAD7_last

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.482[a]	.233	.232	5.248	.233	218.614	10	7209	.000

a. Predictors: (Constant), WSAS_first, Alcohol_u_wk_quadratic, Age, Expectancy, Ethnicity_binary, Disability_binary, Unemployed_first, GAD7_first, PHQ9_first, Alcohol_u_wk

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	60216.208	10	6021.621	218.614	.000[b]
	Residual	198568.791	7209	27.545		
	Total	258784.999	7219			

a. Dependent Variable: GAD7_last

b. Predictors: (Constant), WSAS_first, Alcohol_u_wk_quadratic, Age, Expectancy, Ethnicity_binary, Disability_binary, Unemployed_first, GAD7_first, PHQ9_first, Alcohol_u_wk

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	2.636	.375		7.020	.000	1.900	3.372
	Alcohol_u_wk	-.020	.012	-.034	-1.756	.079	-.043	.002
	Alcohol_u_wk_quadratic	.001	.000	.050	2.586	.010	.000	.001
	Age	-.030	.005	-.068	-6.452	.000	-.039	-.021
	Ethnicity_binary	.742	.211	.037	3.511	.000	.328	1.155
	Disability_binary	.689	.191	.039	3.613	.000	.315	1.062
	Unemployed_first	1.971	.163	.132	12.120	.000	1.652	2.290
	Expectancy	-.172	.035	-.052	-4.959	.000	-.240	-.104
	PHQ9_first	.161	.015	.162	10.714	.000	.131	.190
	GAD7_first	.306	.017	.246	18.497	.000	.273	.338
	WSAS_first	.046	.009	.069	5.232	.000	.029	.063

a. Dependent Variable: GAD7_last